Service Manual

Clamps for Bolt-on Arms and Turnafork™

Serial Numbers 634448 through 666419

Basic Clamps
Sideshifting Clamps
Revolving Clamps
Turnafork™ Model C4T

Manual Number 667447

cascade®

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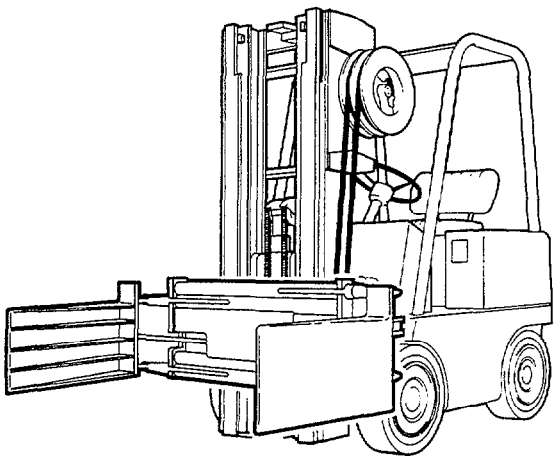
Section 1 Introduction

This manual provides the installation instructions, periodic maintenance requirements, troubleshooting procedures, and service guides for the following Cascade lift truck attachments:

- Basic Clamp for Bolt-on Arms Models C2B, C3B, C4B, C6B, and C7B
- Sideshifting Clamp for Bolt-on Arms Models C2S, C3S, C4S, C6S, and C7S
- Revolving Clamps for Bolt-on Arms Models C2R, C3R, C4R, C6R, and C7R
- Turnafork™ Model C4T

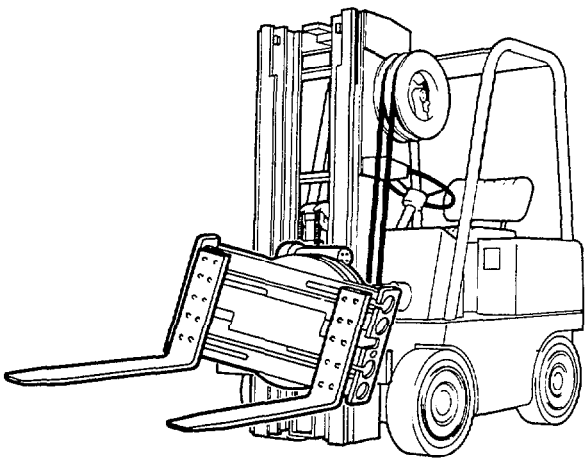


1.1 Truck System Requirements

Pressure: Your lift truck should supply sufficient hydraulic pressure to handle the heaviest load. PRESSURE MUST NOT EXCEED 2000 PSI.

Volume: **Basic Clamps, Sideshifting Clamps, and Turnafork**—5-20 gpm
Revolving Clamps—Required volume to obtain rated rotation speed specification:
C2R, C3R—10 gpm
C4R—15 gpm
C6R—20 gpm
C7R—20 gpm

NOTE: If you have questions concerning these ratings, call Cascade's Service Department, toll-free, 800-547-5266.



1.2 Special Instructions Definitions

⚠WARNING

A statement preceded by **⚠WARNING** is information that should be acted upon to prevent **bodily injury.** A **WARNING** is always inside a ruled box.

CAUTION

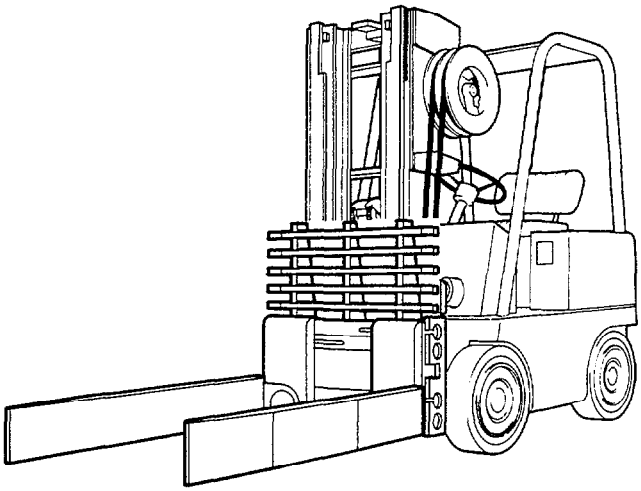
A statement preceded by **CAUTION** is information that should be acted upon to prevent **machine damage.**

IMPORTANT

A statement preceded by **IMPORTANT** is information that possesses special significance.

NOTE

A statement preceded by **NOTE** is information that is handy to know and may make your job easier.



Section 2 Installation Instructions

WARNING: Rated capacity of the truck/attachment combination is a responsibility of the original truck manufacturer and may be less than that shown on the attachment nameplate. Consult the truck nameplate.

2.1 Truck System Requirements

- Truck relief valve setting: 2000 psi maximum.
- Truck hydraulic system should provide the following rates of flow:

  Volume: **Basic Clamps, Sideshifting Clamps, and Turnafork**—5-20 gpm
  Revolving Clamps—Required volume to obtain rated rotation speed specification:
  C2R, C3R—10 gpm
  C4R—15 gpm
  C6R—20 gpm
  C7R—20 gpm

  NOTE: If you have questions concerning these ratings, call Cascade's Service Department, toll-free, 800-547-5266.
- Recommended hose and fitting size:

  C2B Basic Clamps and C2S Sideshifting Clamps: No. 6 hoses with minimum fitting orifices of .297 (9/32) inch.

  All others: No. 8 hoses with minimum fitting orifices of 13/32 inch.
- Truck carriage must conform to the Industrial Truck Association (ITA) dimensional standards as shown in the following chart.

Mounting	Dimension A (in.)	
	Min.	Max.
Class II (C2B, C3B,C4B, C2S, C3S, C4S, C2R, C3R, C4R, C4T)	14.94	15.00
Class III (C4B, C6B, C4S, C6S, C4R, C6R)	18.68	18.74
Class IV (C6B, C7B, C6S, C7S, C6R, C7R)	23.44	23.50

- Make sure the truck carriage is clean and the notches are undamaged.

Section 2 Installation Instructions

2.2 Prior to Installation

1. Install the hydraulic hoses to the **truck junction blocks** using the correct Cascade Attachment Installation Kit. The part numbers are as follows:

   Basic Clamp Model C2B: C-658372

   Basic Clamp Models C3B, C4B, C6B and C7B: C-658373

   Sideshifting Clamp Model C2S: C-663531

   Sideshifting Clamp Models C3S, C4S, C6S, and C7S and Turnafork Model C4T: C-663532

   Revolving Clamp Models C2R, C3R, C4R, and C6R: C-663585

   Revolving Clamp Model C7R: C-663598

   OR,

   use hoses and fittings as shown in Figure 1, 2, 3, 4, 5, or 6. Be careful not to pinch, twist, or otherwise damage the hoses.

IMPORTANT

In order to conform to industry standard practice, the hoses should be connected to the truck auxiliary valves as indicated by the following chart.

Function, in order of location from operator	Attachment Movement	Motion of the operator's hand
Sideshift	Right	Rearward or up
	Left	Forward or Down
Rotate	Clockwise	Rearward or Up
	Counter-clockwise	Forward or Down
Clamp	Clamp (close)	Rearward or Up
	Release (open)	Forward or Down

CAUTION:

2. Flush the hoses as follows to prevent damage to the attachment hydraulic components.

   a. Connect the hoses from each junction block together.

   b. Start the truck and actuate the truck control valve(s) in both directions for about 30 seconds to carry any debris left in the hoses to the truck hydraulic tank and filter.

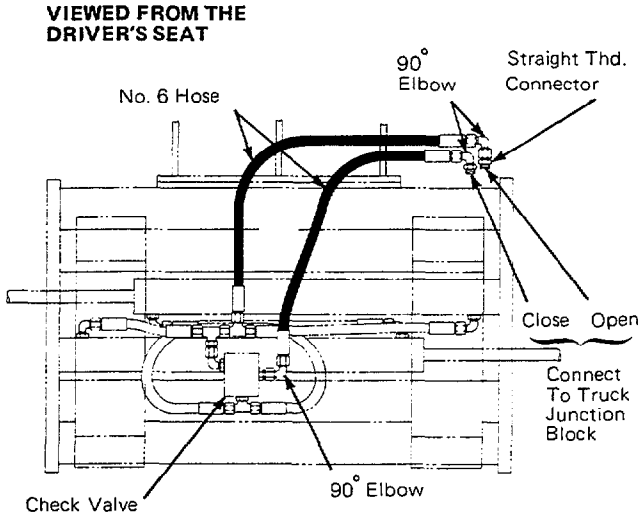


Figure 1. Plumbing Diagram, Model C2B

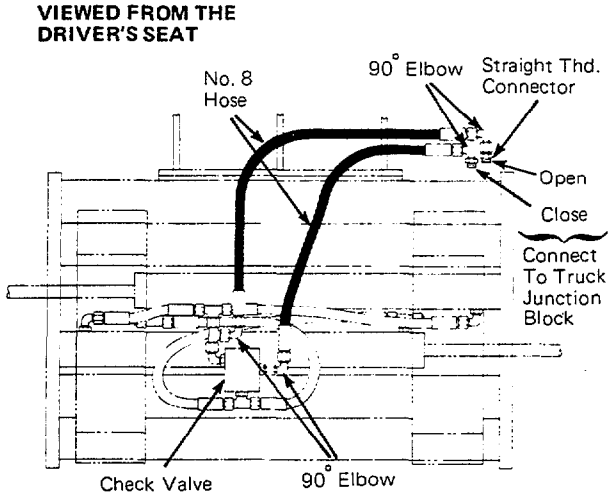
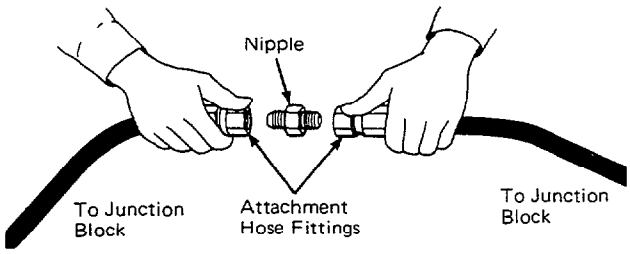


Figure 2. Plumbing Diagram, Models C3B, C4B, C6B, and C7B



2.2 Prior to Installation (Cont.)

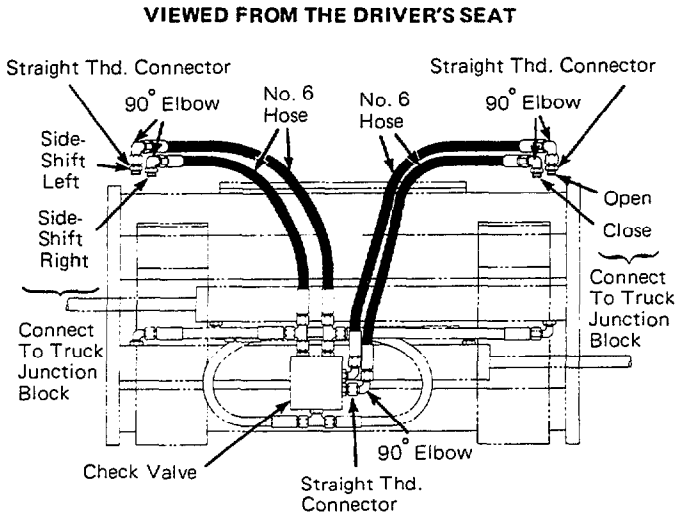


Figure 3. Plumbing Diagram, Model C2S

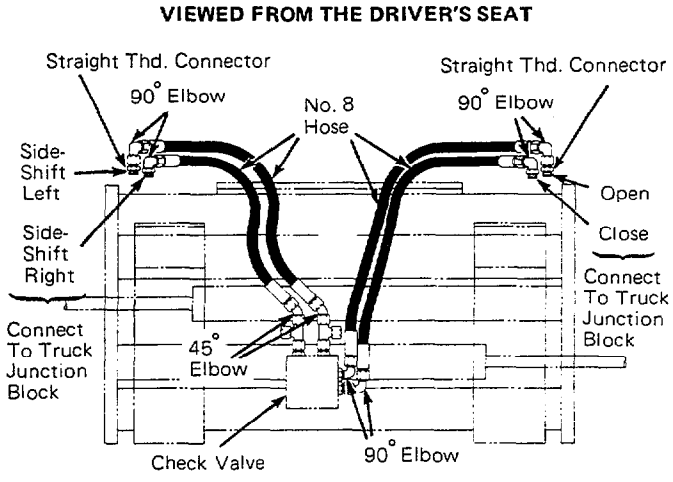


Figure 4. Plumbing Diagram, Models C3S, C4S, C6S, and C7S

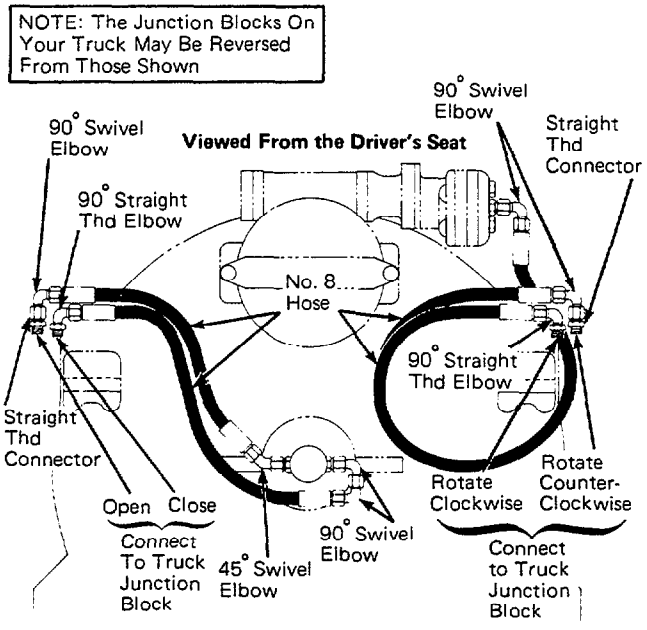


Figure 5. Plumbing Diagram, Models C3R, C4R, and C6R

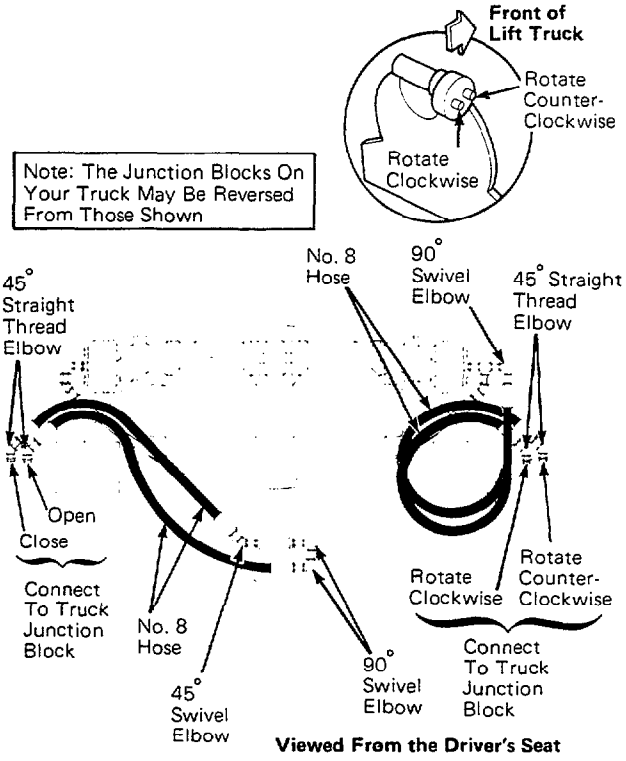
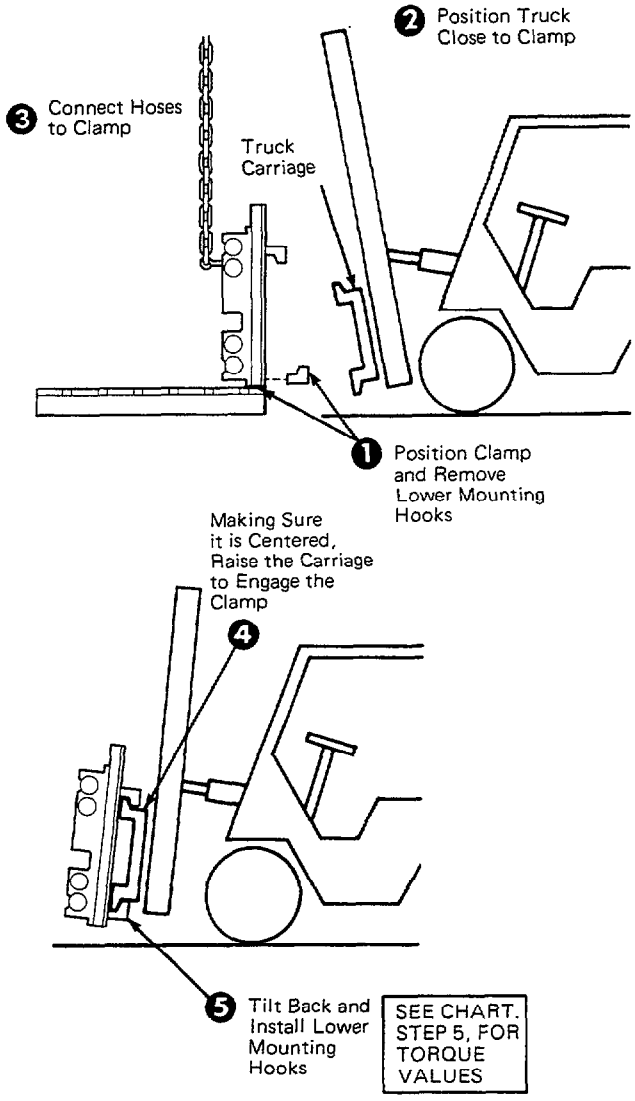


Figure 6. Plumbing Diagram, Model C7R

2.3 Installation

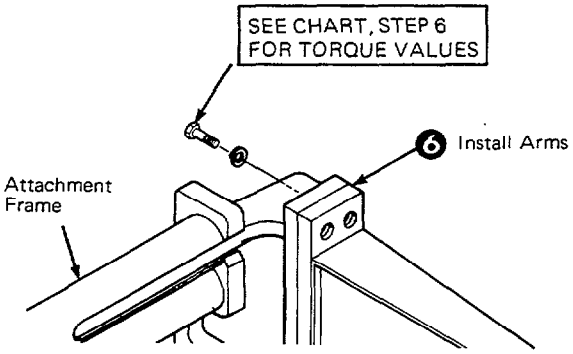
1. Using a suitable hoist and chain, position the clamp as shown and remove the lower mounting hooks.
2. Position the truck close enough so the hoses on the junction block(s) can be connected to the attachment.
3. Connect the hoses to the attachment as shown in the appropriate plumbing diagram.
4. Raise the truck carriage and engage the attachment upper mounting hooks. Center the attachment on the carriage, making sure the positioning block is engaged in a notch on the carriage.
5. Tilt the mast back and install the lower mounting hook. Lube-torque the capscrews as shown on the following chart.

Attachment (all models)	Mounting Class	Torque Value (lubed)
C2R, C3R	II	74-76 ft.-lb.
C2B, C3B, C4B, C6B, C2S, C3S, C4S, C6S	II, III	103-113 ft.-lb.
C4R	II, III	85-90 ft.-lb.
C6R	III, IV	85-90 ft.-lb.
C6B, C6S, C7R	IV	180-200 ft.-lb.
C7B, C7S	IV	265-295 ft.-lb.


2 Position Truck Close to Clamp
3 Connect Hoses to Clamp
Truck Carriage
1 Position Clamp and Remove Lower Mounting Hooks
Making Sure it is Centered, Raise the Carriage to Engage the Clamp
4
5 Tilt Back and Install Lower Mounting Hooks
SEE CHART, STEP 5, FOR TORQUE VALUES

6. Install the arms. Lube-torque the capscrews as shown on the following chart.

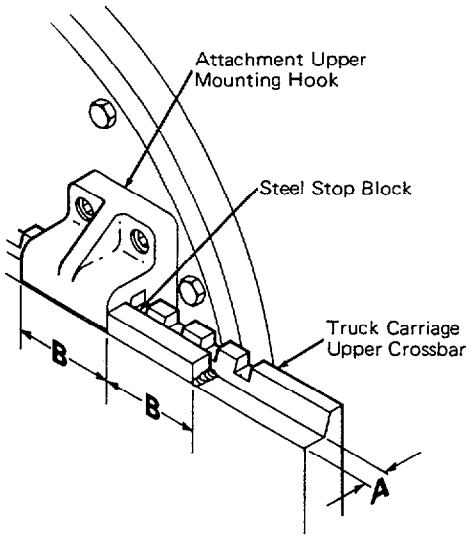
Attachment (all models)	Arm capscrew torque values (lubed)
C2, C3	100-120 ft.-lb.
C4	180-220 ft.-lb.
C6	420-465 ft.-lb.



2.4 Attachment Stop Blocks

Cascade recommends that a steel block be permanently welded on each side of the truck carriage upper crossbar adjacent to each attachment upper mounting hook. To perform the installation:

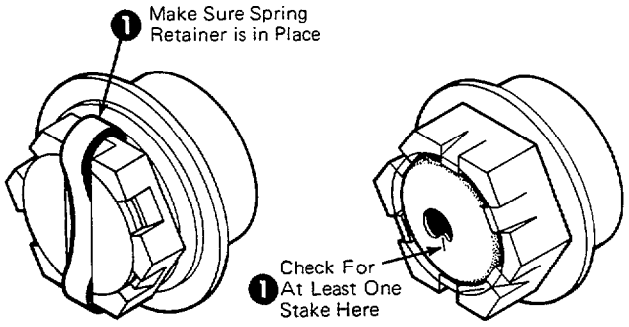
1. Select square steel stock with a width about equal to the flat of the carriage upper crossbar (dimension A).
2. Cut two blocks from the stock, each about as long as the width of the attachment upper mounting hook (dimension B).
3. Position the blocks adjacent to the upper mounting hooks. The blocks should not extend behind the flat of the carriage upper crossbar (dimension A).
4. Weld the blocks in place. Make sure you protect adjacent hoses and hydraulic components from weld splatter.



2.5 Prior to Operation

1. Check the cylinder anchor nuts to make sure they are secure. If your clamp has old-style anchor nuts, make sure the spring retainer is in place. If you have new-style anchor nuts, make sure they are properly staked.
2. Before picking up a load, operate the attachment through a full cycle to force any air from the system to the truck hydraulic tank. Check for leaks.
3. Pick up a maximum load and operate the clamp. If the clamp does not function correctly, recheck the plumbing. If the clamp drops the load, contact Cascade's Service Department, telephone 800-547-5266 (toll-free), or, in Oregon, call 666-1511.

WARNING: Make sure there are no people in the vicinity of the attachment when picking up a load.



OLD-STYLE CYLINDER ANCHOR NUT

NEW-STYLE CYLINDER ANCHOR NUT

Section 3 Periodic Maintenance

3.1 100 Hour Maintenance

Every time the lift truck is serviced or every 100 hours of truck operation, whichever comes first, complete the following maintenance procedures.

☐ Check the cylinder anchor nuts for looseness.

IMPORTANT:
After completing any service procedure, always test each function through 5 complete cycles. First test the clamp empty to bleed excess air trapped in the system. Then test each function with a load to make sure the clamp operates correctly before returning it to the job.

3.2 500 Hour Maintenance

After each 500 hours of lift truck operation, in addition to the 100-hour maintenance procedure, perform the following procedures.

☐ Retorque the mounting capscrews. Use the torque specifications shown in Section 2.

Rotating Clamps Only

☐ Lubricate the ring gear/bearing assembly with wheel bearing grease. Rotate the clamp one full turn during lubrication.

☐ Remove the plug on the back of the baseplate and retorque all the ring gear/bearing assembly capscrews to 65-70 ft.-lb. (120-125 ft.-lb. on C7R). Replace the plug.

☐ Remove the plug on the rotator drive gearcase and fill to capacity with Cascade Rotator Drive Lubricant (Cascade part number C-656300) or Keystone WG-1. Replace the plug.

3.3 1000 Hour Maintenance

After each 1000 hours of lift truck operation, in addition to the 100-hour and 500-hour maintenance procedures, perform the following procedure.

☐ Check the arm bushings. If they are worn, marred, or deeply scratched, replaced the bushings.

3.4 2000 Hour Maintenance

After each 2000 hours of lift truck operation, in addition to the 100-hour, 500-hour, and 1000-hour maintenance procedures, perform the following procedure.

☐ Replace all sliding arm bushings.

Section 4 Troubleshooting

4.1 General Procedures

WARNING: Before servicing any hydraulic component, relieve pressure in the system. Open the arms 1 or 2 inches, turn the truck off, and open the truck auxiliary valves several times in both directions.

After completing any service procedure, always test the function through several cycles. First test the attachment empty to bleed air trapped in the system to the truck system. Then test the attachment with a load to be sure it operates correctly before returning it to the job.

Stay clear of the load while testing. Do not raise the load more than 3 inches off the floor while testing.

4.1-1 Truck System Requirements

Pressure: Your lift truck should supply sufficient hydraulic pressure to handle the heaviest load. PRESSURE MUST NOT EXCEED 2000 PSI.

Volume: **Basic Clamps, Sideshifting Clamps, and Turnafork**—5-20 gpm
Revolving Clamps—Required volume to obtain rated rotation speed specification:
C2R, C3R—10 gpm
C4R—15 gpm
C6R—20 gpm
C7R—20 gpm

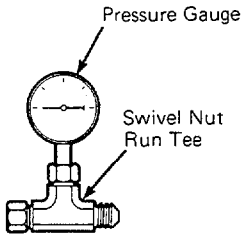
NOTE: If you have questions concerning these ratings, call Cascade's Service Department, toll-free, 800-547-5266.

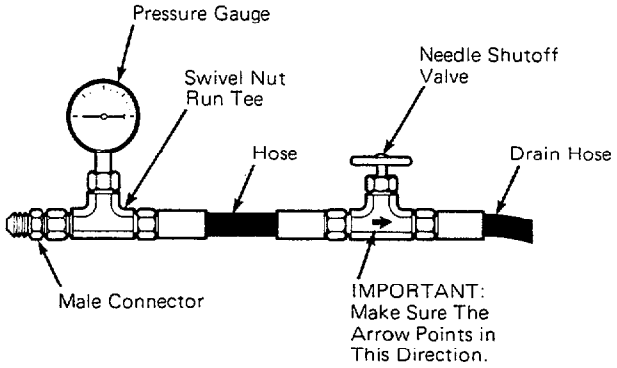
4.1-2 Tools Required

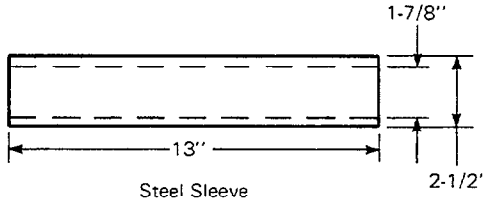
In addition to a normal selection of hand tools, you will need:

- Two pressure gauges capable of measuring pressure to 2500 psi.
- Two No. 6 swivel nut run tees (37° JIC) suitable for mounting gauges.
- Two No. 8 swivel nut run tees (37° JIC) suitable for mounting gauges.
- Two No. 6 JIC plugs for hose ends.
- Two No. 8 JIC plugs for hose ends.
- Two No. 6 metal caps for ports.
- Two No. 8 metal caps for ports.
- Two needle shutoff valves, rated for 2500 psi service, minimum. (Recommended supplier for needle shutoff valves: Marsh Instrument Co., Skokie, Ill.)
- Two steel sleeves as shown by the accompanying illustration.

Install the gauges in the tees. In some tests, you will install the needle valve and a drain line in conjunction with the gauge arrangement.







4.1-3 Get All The Facts Before You Begin Working On The Clamp

It is important that you gather all the facts regarding the problem before you begin service procedures. The best way is to talk with the operator. Ask for a complete description of the malfunction. The following guidelines will help you decide where to begin your troubleshooting procedures.

A. Clamp Circuit

- Clamp drops load after it has been picked up.
- Clamp will not carry load up to its rated capacity.
- Clamp arms will not function properly.
- Clamp drops the load when sideshifting or rotating.

If you encounter one of these problems, refer to Paragraph 4.3.

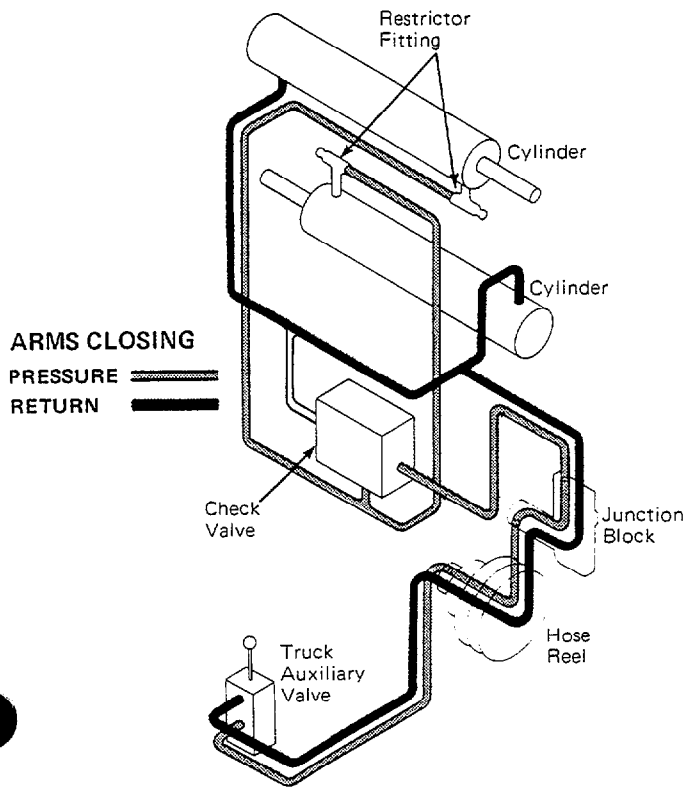
B. Rotating Circuit (revolving clamps only)

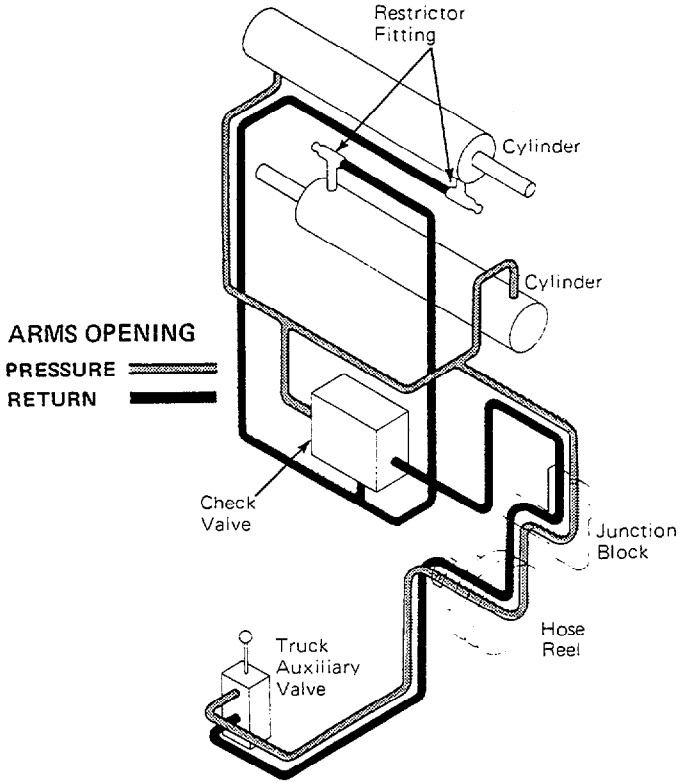
- Clamp will not rotate.
- Clamp will not rotate loads up to its rated capacity.
- Clamp rotates in one direction only.

If you encounter one of these problems, refer to Paragraph 4.4.

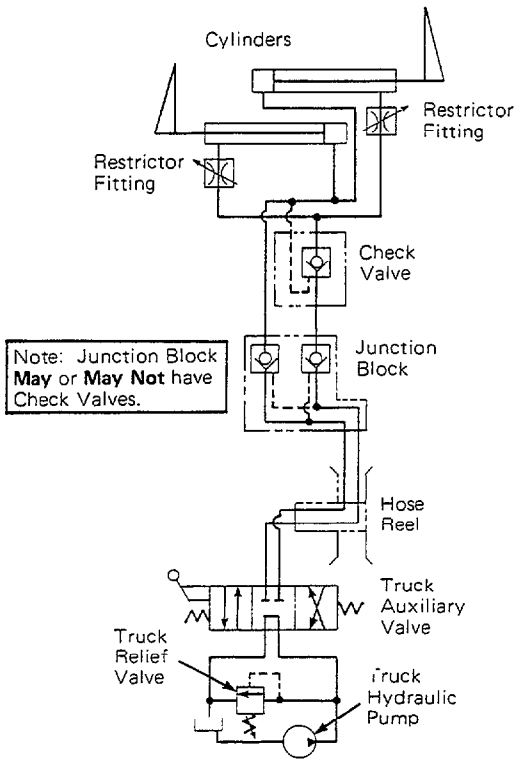
4.2 Plumbing

4.2-1 Hosing Diagram, Basic Clamps (including Turnafork)





4.2-2 Circuit Schematic, Basic Clamps (including Turnafork)

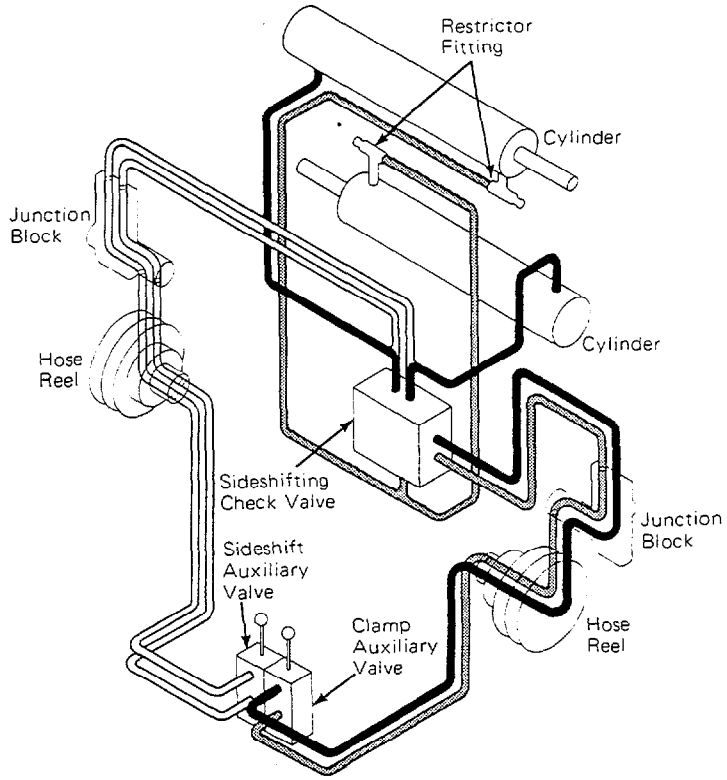


4.2-3 Hosing Diagram, Sideshifting Clamps

ARMS CLOSING

PRESSURE

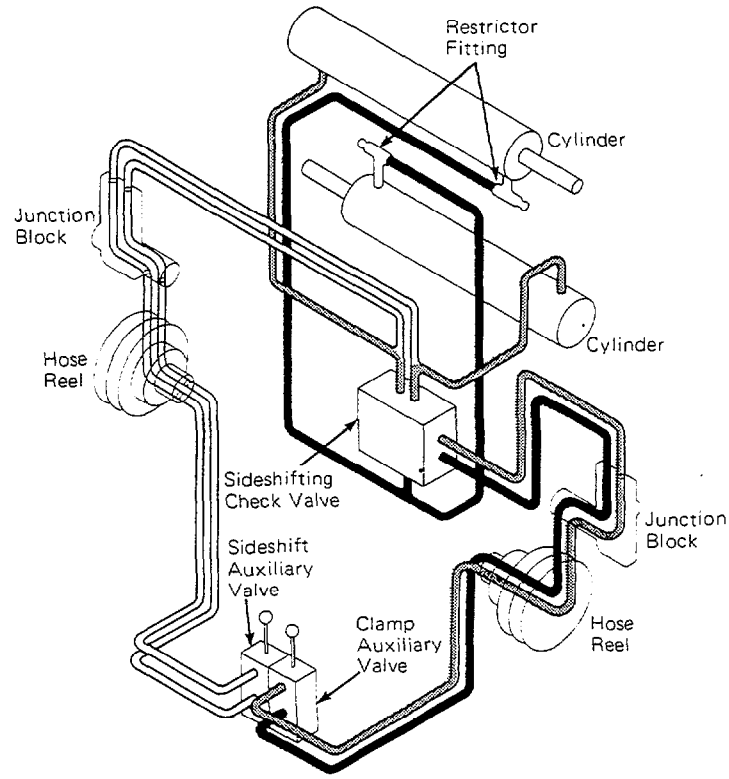
RETURN



ARMS OPENING

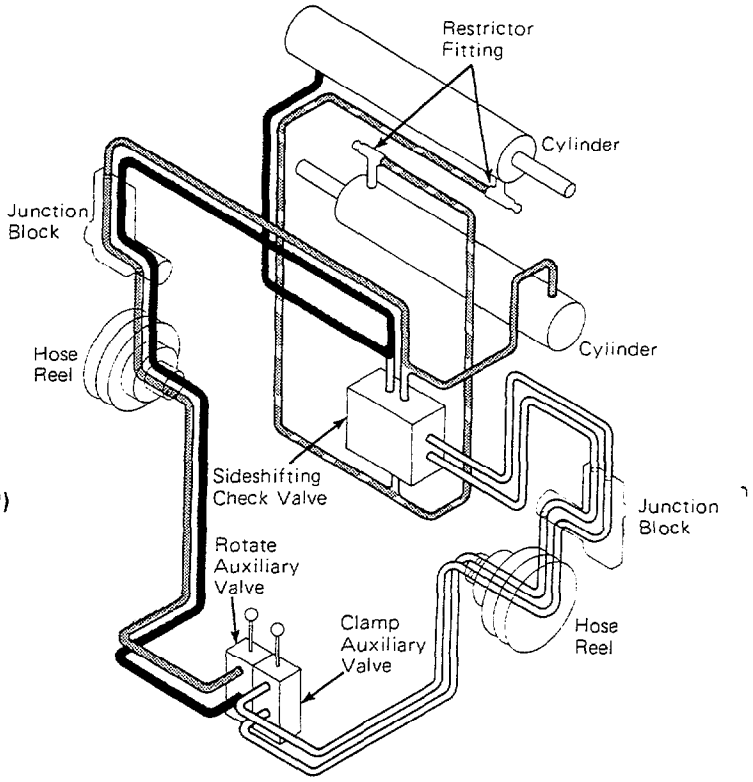
PRESSURE

RETURN

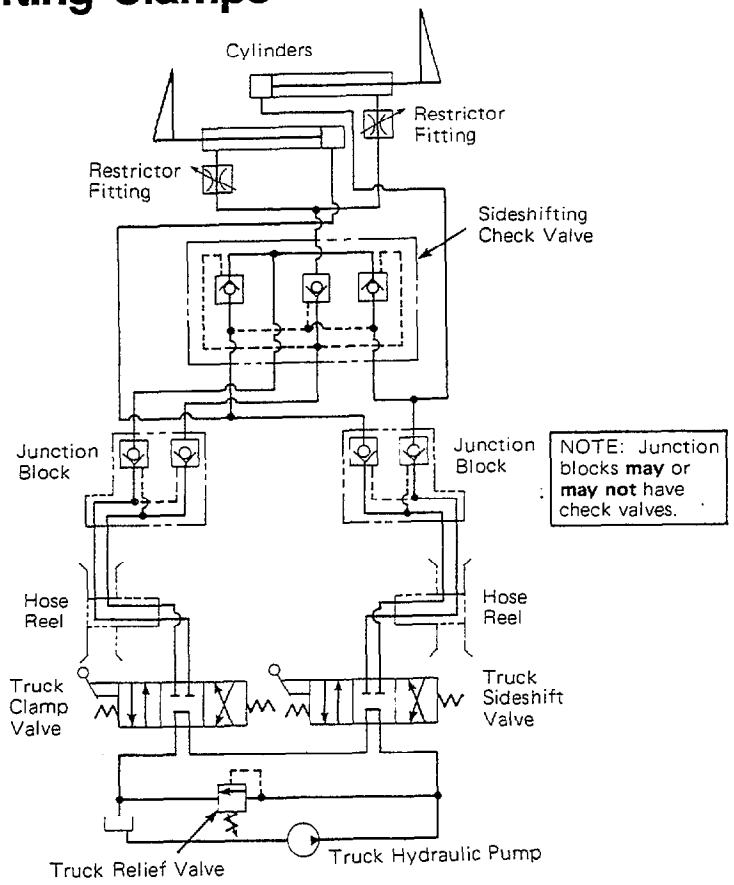


4.2-3 Hosing Diagram, Sideshifting Clamps (Cont.)

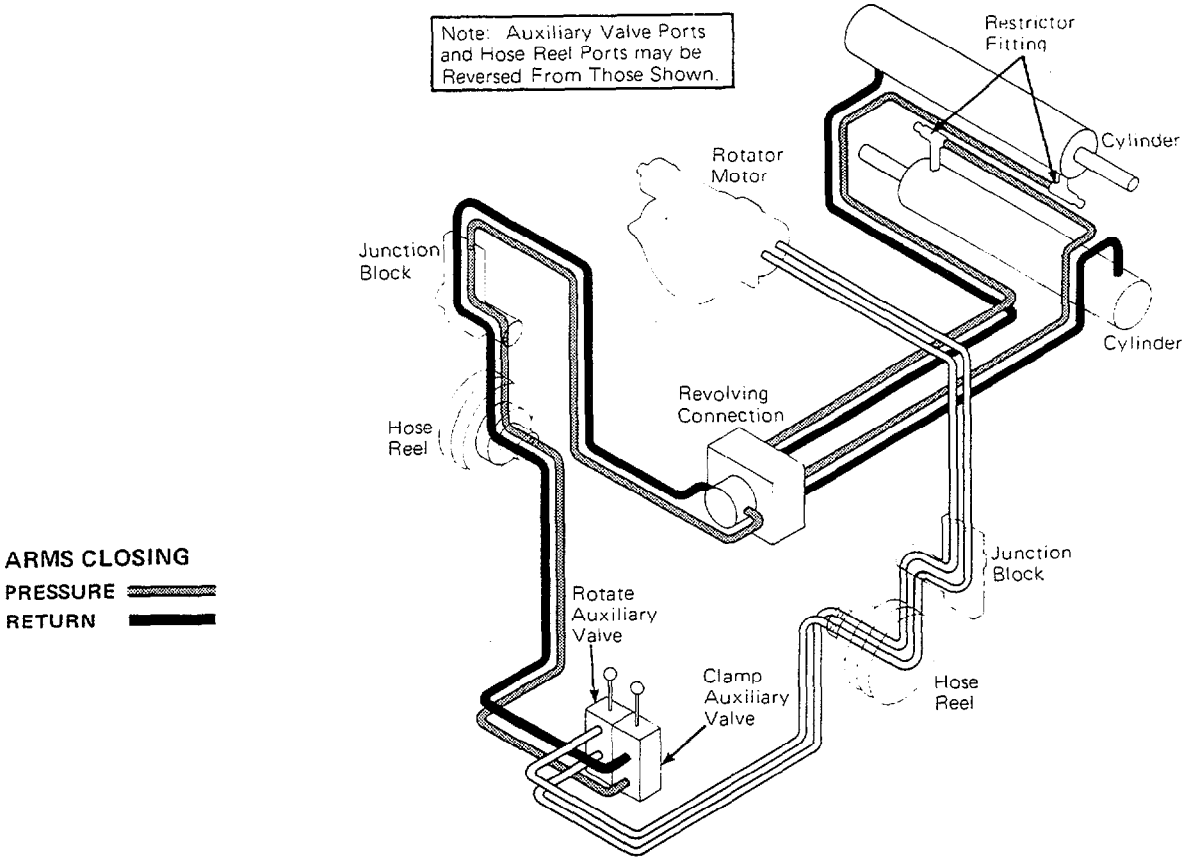
SIDESHIFTING
(SIDESHIFT LEFT SHOWN)
PRESSURE
RETURN

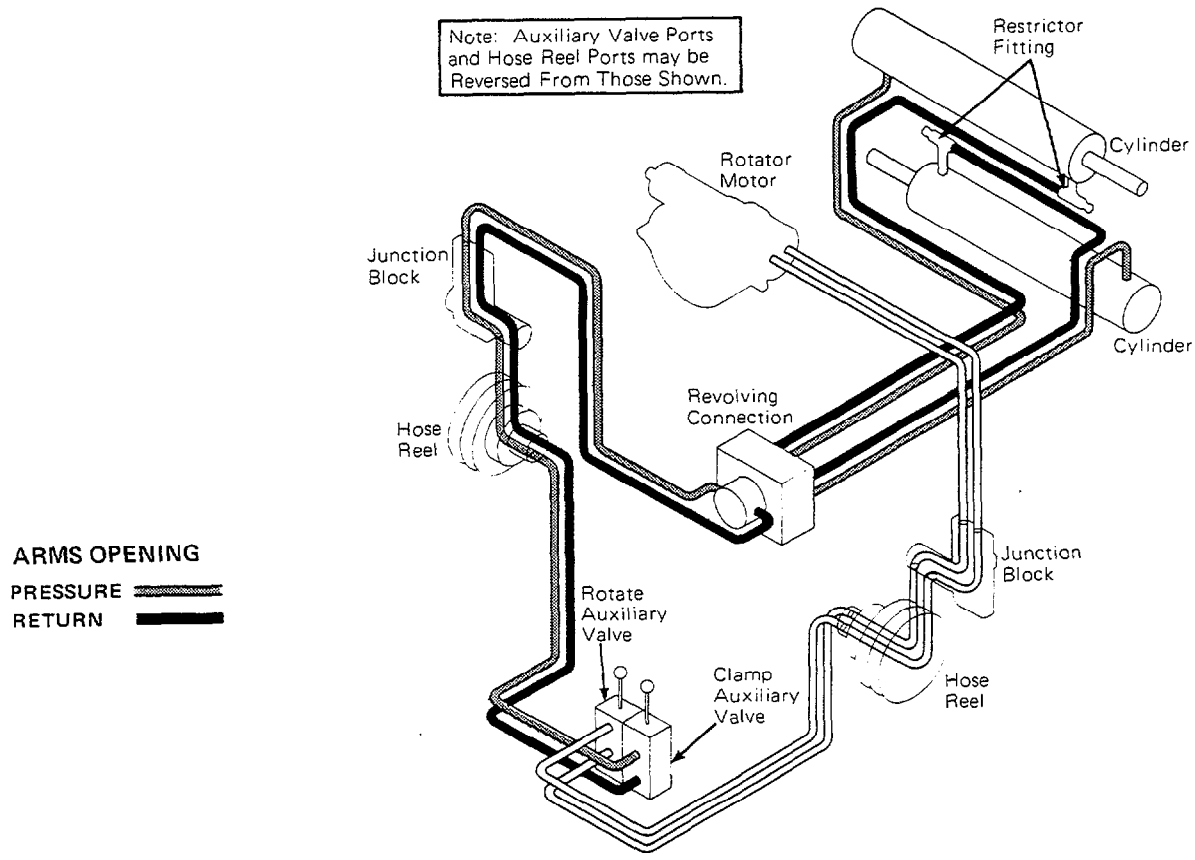


4.2-4 Circuit Schematic, Sideshifting Clamps

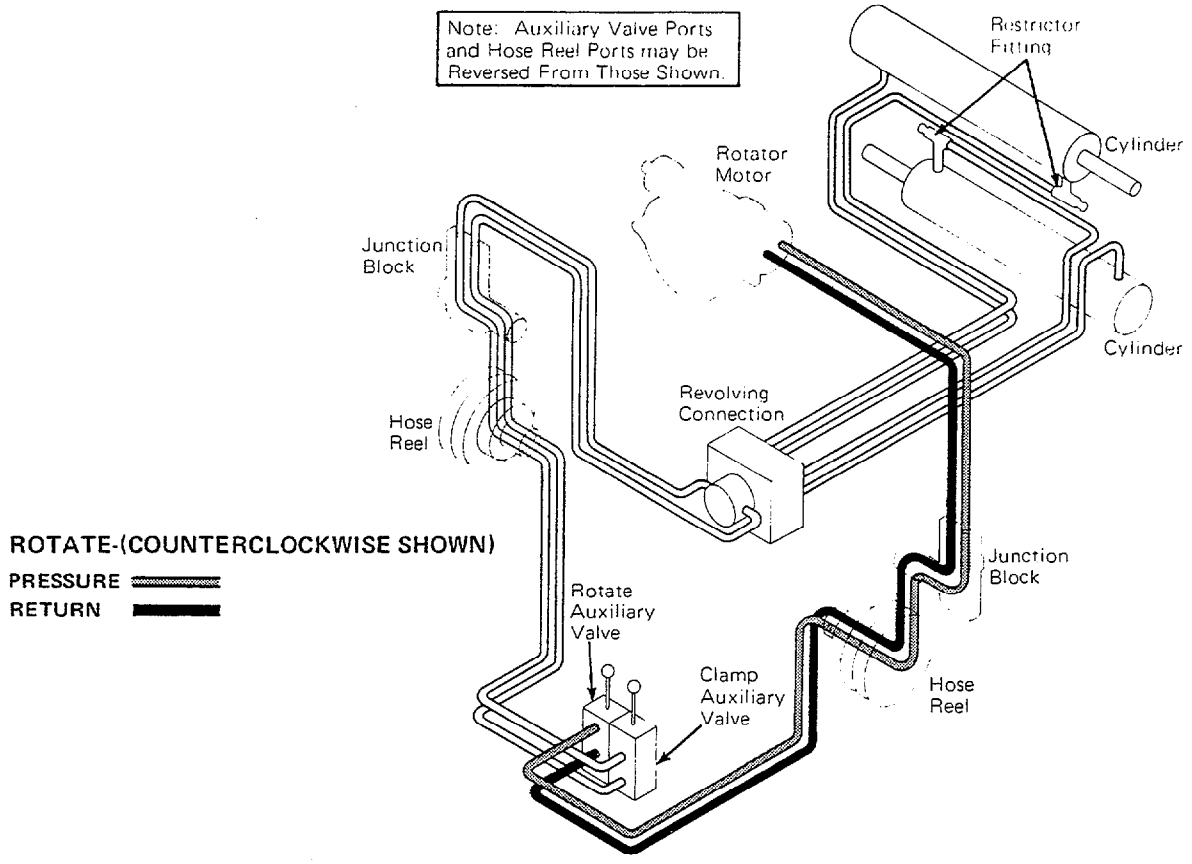


4.2-5 Hosing Diagram, Revolving Clamps

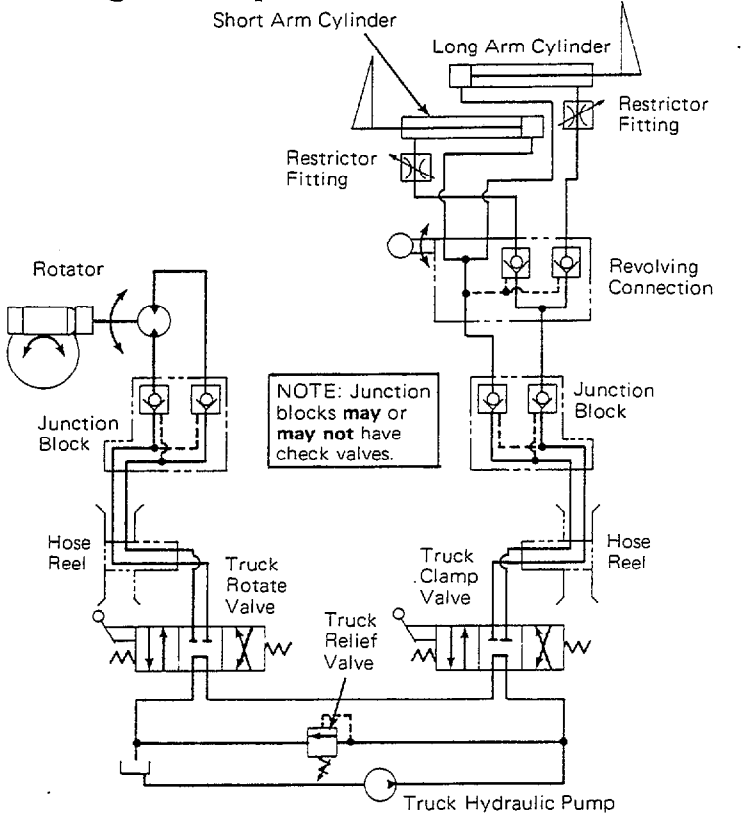




4.2-5 Hosing Diagram, Revolving Clamps (Cont.)



4.2-6 Circuit Schematic, Revolving Clamps



4.3 Clamp Circuit Troubleshooting

There are four potential problem areas that could affect clamping force.

- Insufficient hydraulic pressure from the lift truck.
- External leaks.
- Malfunctioning check valve.
- Worn or defective cylinder seals.

To isolate the problem area, complete the following check list in the **exact** sequence indicated.

General Pressure Test

☐ Rotate the clamp so the arms are side-by-side (revolving clamps only).

☐ Open the clamp arms and remove the bumper plate from the front of the attachment.

☐ Disconnect the cylinder rod ends from the arms.

IMPORTANT: Refer to the procedures described in Section 5, Paragraph 5.2-1, Step 2.

CAUTION: Rods will drop as soon as they disengage the frame. Protect the rod surface.

☐ Retract the cylinders far enough to slip the steel sleeves over the cylinder rods.

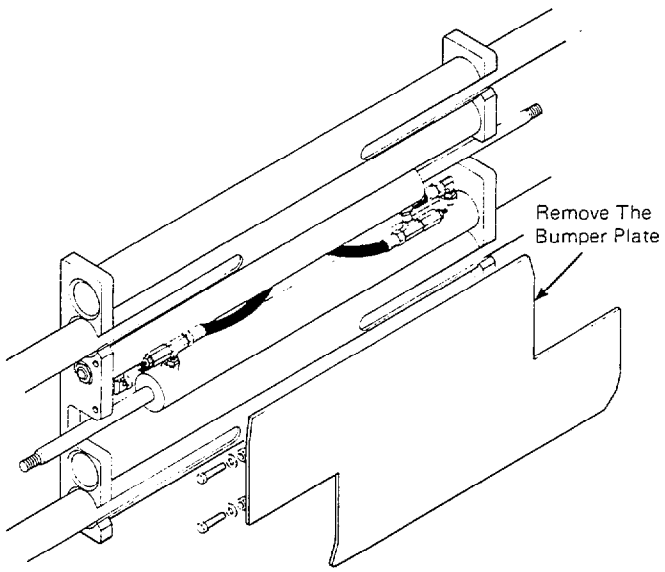
☐ Extend the cylinders and reconnect the rods to the arms with the sleeves in place. It is not necessary to "lock" the nut or install the keeper.

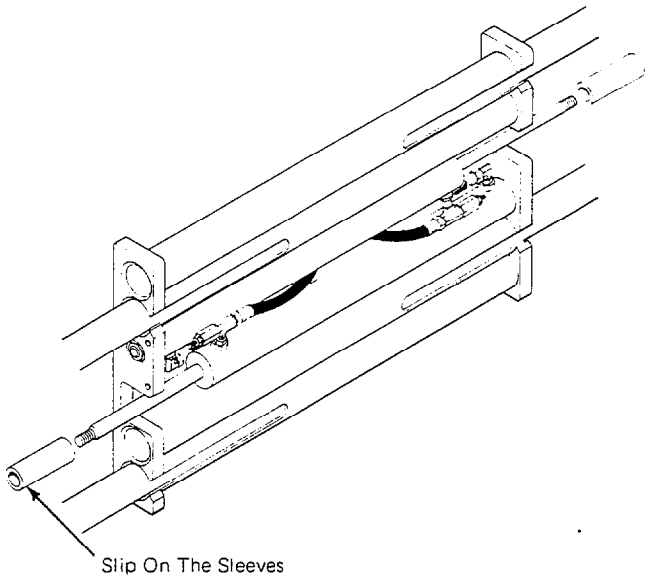
☐ Remove the supply hose to the rod end port restrictor fitting of one of the cylinders. Install a gauge into the open end of restrictor fitting, then reconnect the cylinder supply hose to the gauge tee. In the case of a revolving clamp, install gauges in the rod end restrictor fittings of **both** cylinders.

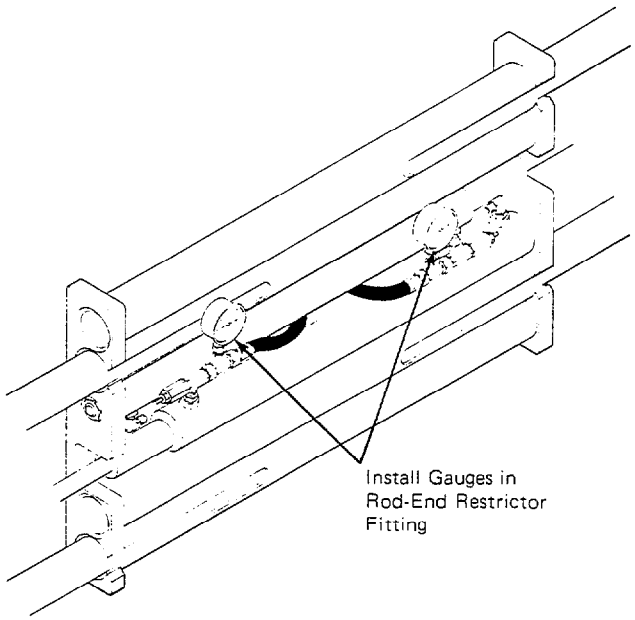
☐ Slowly retract the cylinders (arms moving together) until the sleeve contacts the cylinder end. Make sure the gauge assembly does not interfere with the closing arms. The arms are now blocked partially open (or cylinders partially extended).

☐ Pull the clamp control handle to the "clamp" position and hold for a few seconds.

☐ Return the handle to neutral. The gauge(s) should register within 100 psi of specified truck pressure. If it does not, check the pressure delivered by the truck. Refer to the truck service manual. Adjust and repair as necessary. TRUCK PRESSURE MUST NOT EXCEED 2000 PSI. Recheck cylinder pressure.







General Pressure Test (Cont.)

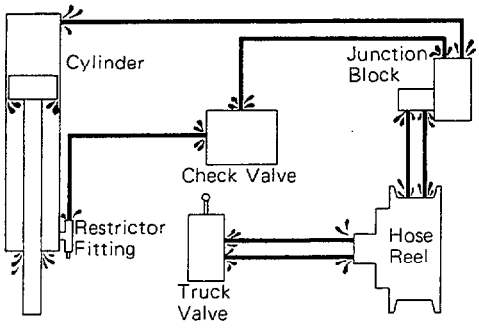
- ☐ If the truck system is OK, watch the gauge(s). If it registers a drop of more than 100 psi in one minute, check for external leaks in the system. Refer to the accompanying diagram. Repair the leaks and recheck cylinder pressure. If there are no external leaks, test the check valve as follows.
- ☐ NON-REVOLVING CLAMPS ONLY. Remove the gauge tee from the one cylinder rod end port, but keep it connected to the hose. Remove the hose to the rod end port of the other cylinder. Cap both cylinder ports and plug the hose that does not have the gauge connected.
- ☐ REVOLVING CLAMPS ONLY. Remove both gauge tees from the cylinder rod end ports, but keep them connected to the hoses. Cap both open cylinder ports.
- ☐ Connect a needle shutoff valve and drain line to the gauge tee(s). Put the drain line(s) in a suitable container.
- ☐ Open the needle valve(s) no more than 1/2 to 1 turn.
- ☐ Start the truck and let it idle. Put the truck clamp lever to the "clamp" position and hold for 4 or 5 seconds to allow oil to flow to the container.
- ☐ While holding the clamp valve open, close the shutoff valve(s). Keep holding the truck valve open until the gauge(s) reach within 100 psi of truck relief pressure.
- ☐ Return the truck clamp valve to neutral and watch the gauge(s). If the gauge(s) does **not** drop more than 100 psi in one minute, one or both cylinders require service. Refer to Section 5, Paragraph 5.3. If the gauge(s) **does** drop more than 100 psi in one minute, the check valve is faulty and requires service (on revolving clamps, if only one gauge registers a 100 psi drop in one minute, the check valve connected to that hose only is at fault). Refer to Section 5, Paragraph 5.6 or 5.7.
- ☐ After making the necessary corrections, remove the cylinder rod sleeves, reconnect all hoses, and replace the bumper plate. Make sure the cylinder anchors are secure. Refer to Section 5, Paragraph 5.2-1, Step 6 for special instructions regarding cylinder anchor nuts.
- ☐ Cycle the attachment 4 or 5 times without and with a load before returning the attachment to service.

Call Cascade's Service Department

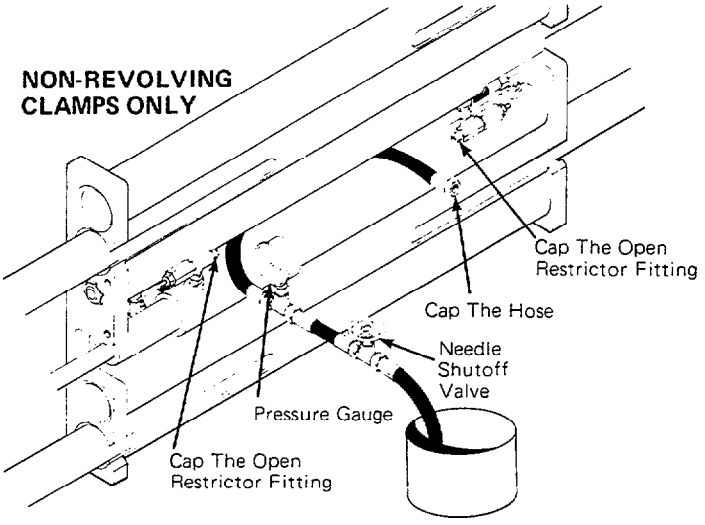
If you have carefully and accurately completed this check list and you still have not solved the problem, call us. Our Service Department is open from 10:00 AM to 8:00 PM **Eastern time.**

Call 800-547-5266 (toll free) In Oregon, 666-1511

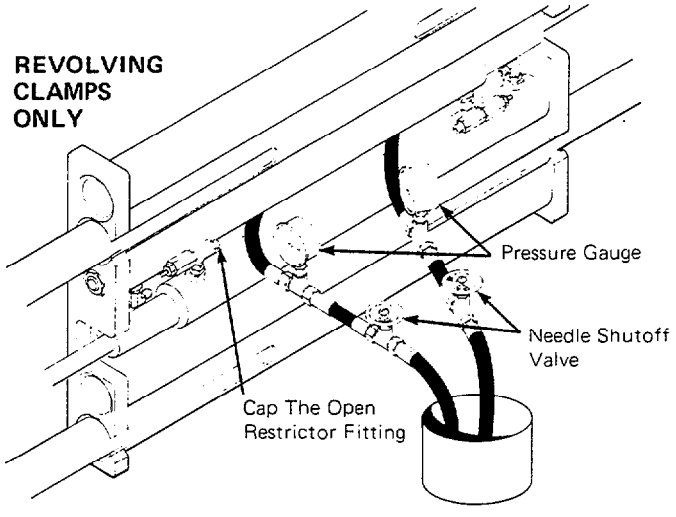
POTENTIAL EXTERNAL LEAK POINTS



NON-REVOLVING CLAMPS ONLY



REVOLVING CLAMPS ONLY



IMPORTANT
Use of Solenoid and One Truck Control Valve, Sideshifting and Revolving Clamps Only

Some trucks use a single auxiliary valve in conjunction with a solenoid valve to control two functions ("clamp" and "sideshift" or "clamp" and "rotate"). To conform to industry standard practice, the system **must** be connected so the "clamp" function operates when the solenoid valve is actuated (button depressed).

If your unit does not operate in this manner, you may inadvertently drop the load when you want to sideshift left or rotate counterclockwise. Make sure your attachment clamps and opens with the solenoid actuated before returning the unit to service.

4.4 Rotate Circuit Troubleshooting (revolving clamps only)

To isolate the problem area in the rotation system, complete the following check list.

4.4-1 Problem:

Clamp will not rotate or will not rotate loads up to its rated capacity.

Probable causes:

- Insufficient truck hydraulic pressure.
- Incorrect load handling.
- Excessive back pressure in the truck hydraulic system.

Tests:

☐ Check the pressure delivered by the truck hydraulic system. A pressure drop of no more than 100 psi at the auxiliary valve port is OK. If the pressure is not as specified, refer to the truck service manual for adjustment or service. PRESSURE MUST NOT EXCEED 2000 PSI.

☐ Make sure the operator is gripping the load as shown in the illustration. Gripping a load, especially a long one, near its end, then attempting to rotate it requires a tremendous amount of torque—often times beyond the capacity of the clamp.

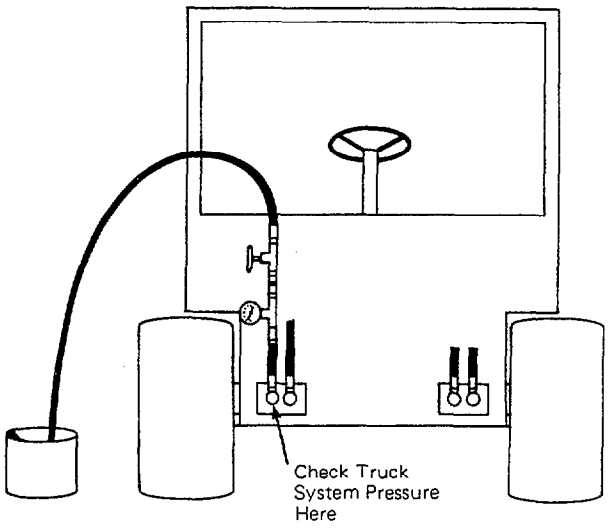
☐ Install a pressure gauge into each port of the hydraulic motor (do not use the needle valve).

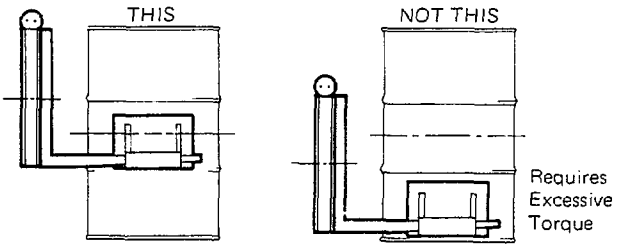
☐ Securely grip a load that weighs close to the capacity of the clamp.

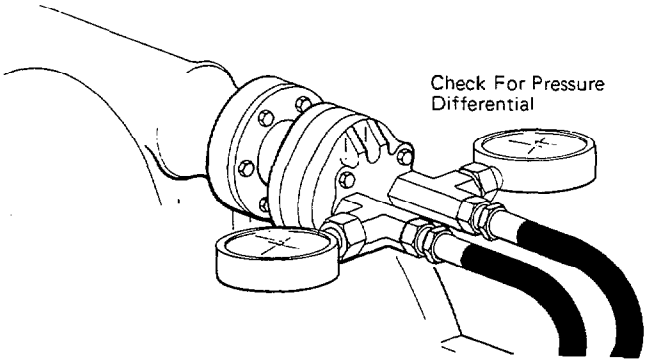
☐ Rotate the load and note the pressure readings on the gauges during rotation.

If the lower pressure reading EXCEEDS 200 psi, you have excessive back pressure in your supply circuit. Check for restrictions such as numerous fittings and elbows, hose sizes less than No. 8, clogged oil filter, etc.

If the lower pressure does NOT EXCEED 200 psi, and the truck pressure is within specifications, the hydraulic motor needs repair. Refer to Section 5, Paragraph 5.9-2 for service procedures.







4.4-2 Problem:

Clamp rotates in one direction only.

Probable cause:
The pilot spool in the junction block that supplies the rotator motor is jammed.

Solution:
Replace the junction block.

Call Cascade's Service Department

If you have carefully and accurately completed this check list and you still have not solved the problem, call us. Our Service Department is open from 10:00 AM to 8:00 PM **Eastern time.**

Call 800-547-5266 (toll free)
In Oregon, 666-1511

5.1 Clamp Removal and Installation

1. Open the clamp arms completely. On revolving clamps, make sure the attachment is rotated so the arms are positioned side-by-side.
2. Remove the lower mounting hooks. For reassembly, lube-torque the lower mounting hook capscrews as shown on the following chart.

Attachment (all models)	Mounting Class	Torque Value (lubed)
C2R, C3R	II	74-76 ft.-lb.
C2B, C3B, C4P, C6B, C2S, C4S, C6S	II, III	103-113 ft.-lb.
C4R	II, III	85-90 ft.-lb.
C6R	III, IV	85-90 ft.-lb.
C6B, C6S, C7R	IV	180-200 ft.-lb.
C7B, C7S	IV	265-295 ft.-lb.

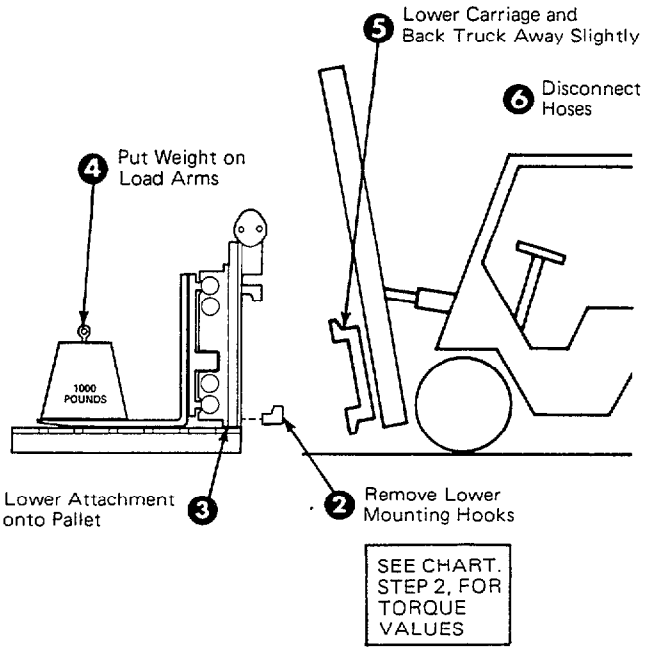
3. Position wooden blocks or a shipping pallet under the attachment. Lower the mast carriage until the attachment is resting on the blocks.
4. On attachments so equipped, set a 1000-pound weight on the forks to hold the attachment upright.

   NOTE: Attachments with load arms other than forks don't require additional stabilizing weight.

5. Making sure the weight on the arms is secure, continue lowering the mast carriage enough to clear the upper mounting hooks. Back the truck away a few inches to gain access to the hoses to the attachment.

> **WARNING:** Before removing any hoses, relieve pressure that might be present in the hydraulic system. With the truck off, open the truck auxiliary control valve(s) several times in both directions.

6. Disconnect and cap the hoses to the attachment. Tag the hoses for ease in reconnecting.
7. For reinstallation, reverse the above procedures, or consult the Installation Instructions, Section 2.


5 Lower Carriage and Back Truck Away Slightly
6 Disconnect Hoses
4 Put Weight on Load Arms
1000 POUNDS
Lower Attachment onto Pallet
3
2 Remove Lower Mounting Hooks
SEE CHART. STEP 2, FOR TORQUE VALUES

5.2 Arms

5.2-1 Arm Removal and Installation

Arm removal is easiest to perform with the attachment mounted on the truck.

1. Fully extend the arms. On rotating clamps, make sure the attachment is rotated so the arms are positioned side-by-side.
2. Remove the nuts retaining the cylinder rods to the arm lugs. On old-style retaining nuts, first remove the spring washer.

   IMPORTANT: A new style retaining nut has a cone-shaped locking washer swaged to the threads of the nut. Locking is achieved when the washer is "dimpled" into the groove in the end of the cylinder rod. To "unlock" the nut, insert a punch or chisel into the hole in the center of the cone-shaped washer and pry up the dimple. If you're careful, the nut may be reused several times.

   NOTE: Pressurizing the cylinders outward will increase friction between the cylinder rod and the lug and may make loosening the nuts easier.
3. Secure the arms with a suitable overhead hoist and chain.

   WARNING: Make sure your overhead hoist has a rated lifting capacity of at least 1000 pounds.
4. Retract the cylinder rods until they come out of engagement with the arm lugs.

   CAUTION: Rods will drop as soon as they disengage the frame. Protect the rod surface.
5. Pull the arms out of the clamp frame.

   IMPORTANT: Each time the arms are removed, inspect the arm guide tubes for scoring. Minor scoring can be removed with a hone. If the guide tubes are badly damaged, the frame must be replaced. Before installing arm carriers, make sure the guide tubes are clean and free of metal projections.
6. For reassembly, reverse the above procedures, except for the following special instructions for cylinder anchor nuts.

   NOTE: When tightening cylinder anchor nuts, pressurizing the cylinders outward will increase friction between the cylinder rod and the lug and may make tightening easier.

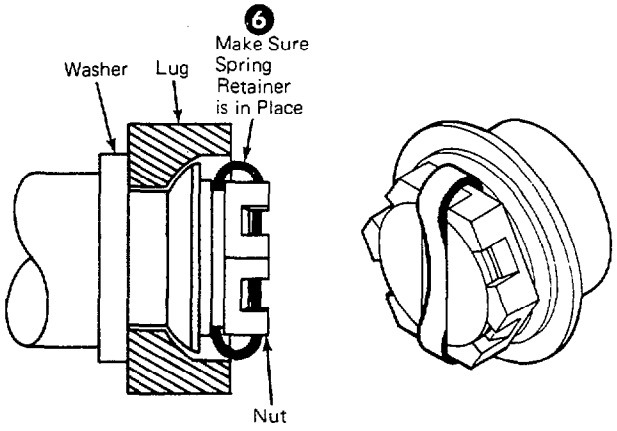
   a. OLD STYLE ANCHOR NUTS. Install the washer onto the cylinder rod, then fit the cylinder rod into the arm carrier. Install the nut. Tighten the nut against the washer. Back the nut off until it aligns with the slot in the cylinder rod. Install the spring retainer. The clearance between the lug and the washer should be about 5/32 inch.

   CAUTION: Do not attempt to remove the looseness or damage to the assembly could result.

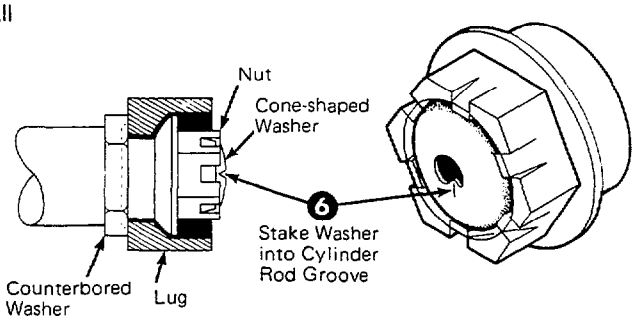
   b. NEW-STYLE ANCHOR NUTS.

   Install the washer onto the cylinder rod with the counterbore-side facing outward (toward the nut), then fit the cylinder rod into the arm carrier. Restrain the washer with a wrench and torque the nut to: C3—55-65 ft.-lb., C4—130-150 ft.-lb., C6 and C7—205-235 ft.-lb. Lock the nut by staking the cone-shaped washer with a case-hardened chisel. Be sure the washer is driven into the slot in the end of the cylinder rod.

   CAUTION: Always use the hex-style washer with the new-style anchor nut. DO NOT use the old-style castellated nut with the hex-style washer.



OLD-STYLE CYLINDER ANCHOR NUT

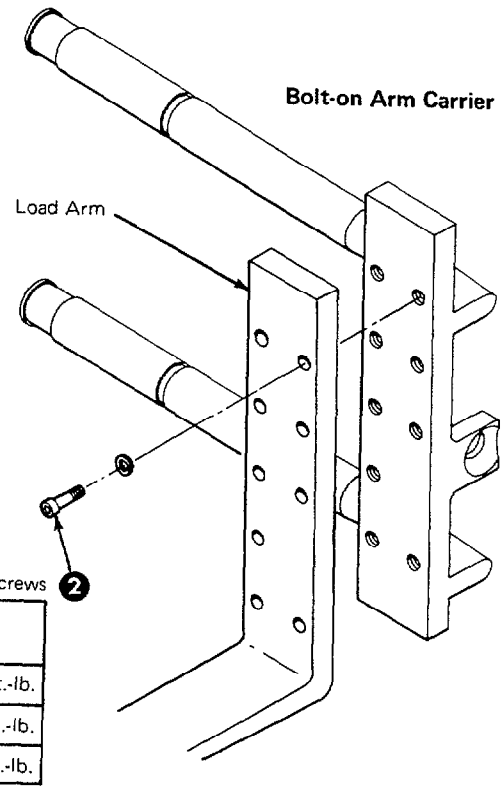


NEW-STYLE CYLINDER ANCHOR NUT

5.2-2 Arm Carrier/Load Arm Disassembly and Reassembly

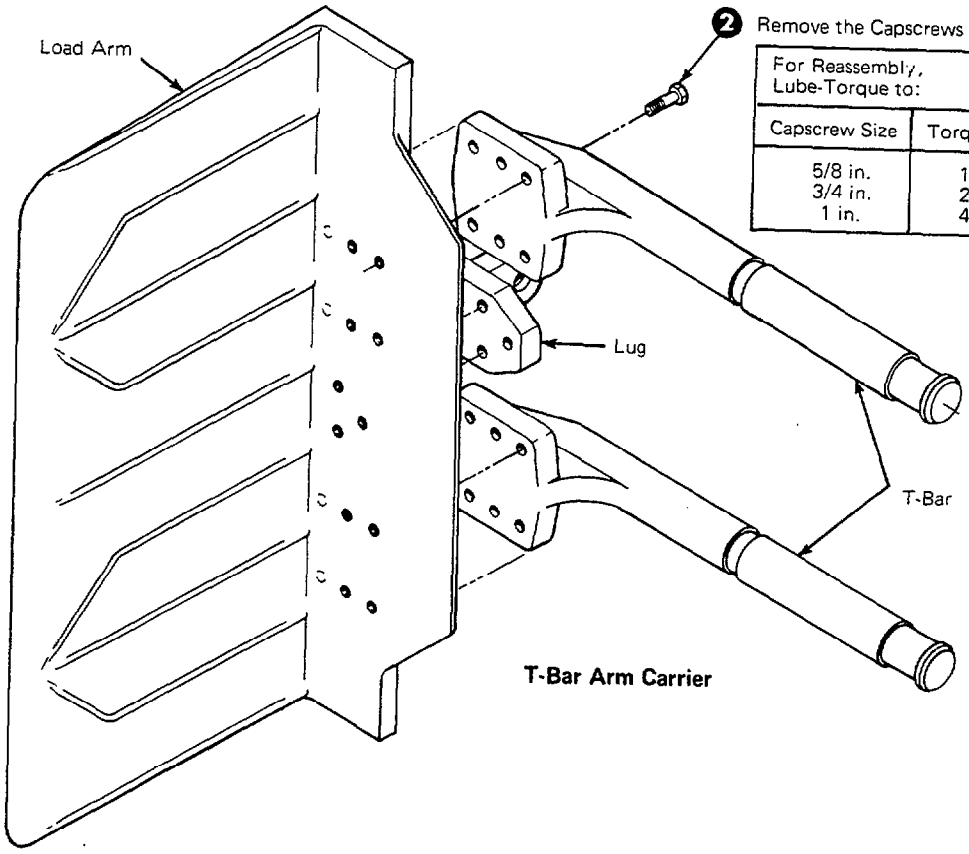
Load arms that are integral with arm carriers cannot be disassembled. Disassemble load arms from bolt-on or T-bar arm carriers according to the following procedures. For disassembly and reassembly procedures for Turna-fork arms, refer to Paragraph 5.2-3.

1. Secure the load arm with a suitable overhead hoist and chain.
2. Remove the capscrews retaining the bolt-on arm carrier or T-bars and cylinder anchor lug to the load arm.
3. For reassembly, reverse the above procedure.



Remove the Capscrews 2

For Reassembly, Lube Torque to:	
C2, C3	100-125 ft.-lb.
C4	180-220 ft.-lb.
C6	420-465 ft.-lb.



For Reassembly, Lube-Torque to:	
Capscrew Size	Torque Value
5/8 in. 3/4 in. 1 in.	120 ft.-lb. 205 ft.-lb. 440 ft.-lb.

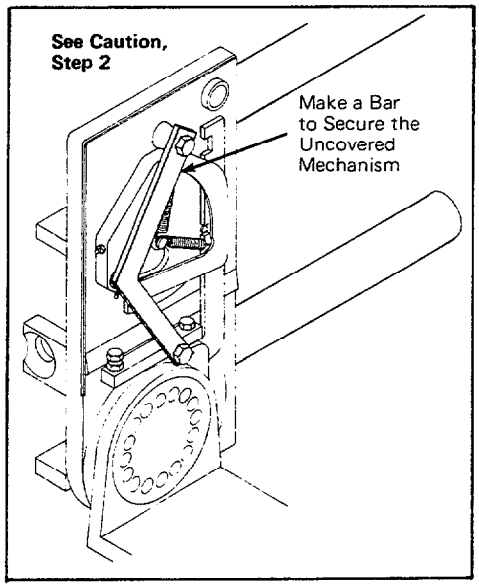
5.2-3 Turnafork Arm Disassembly and Reassembly

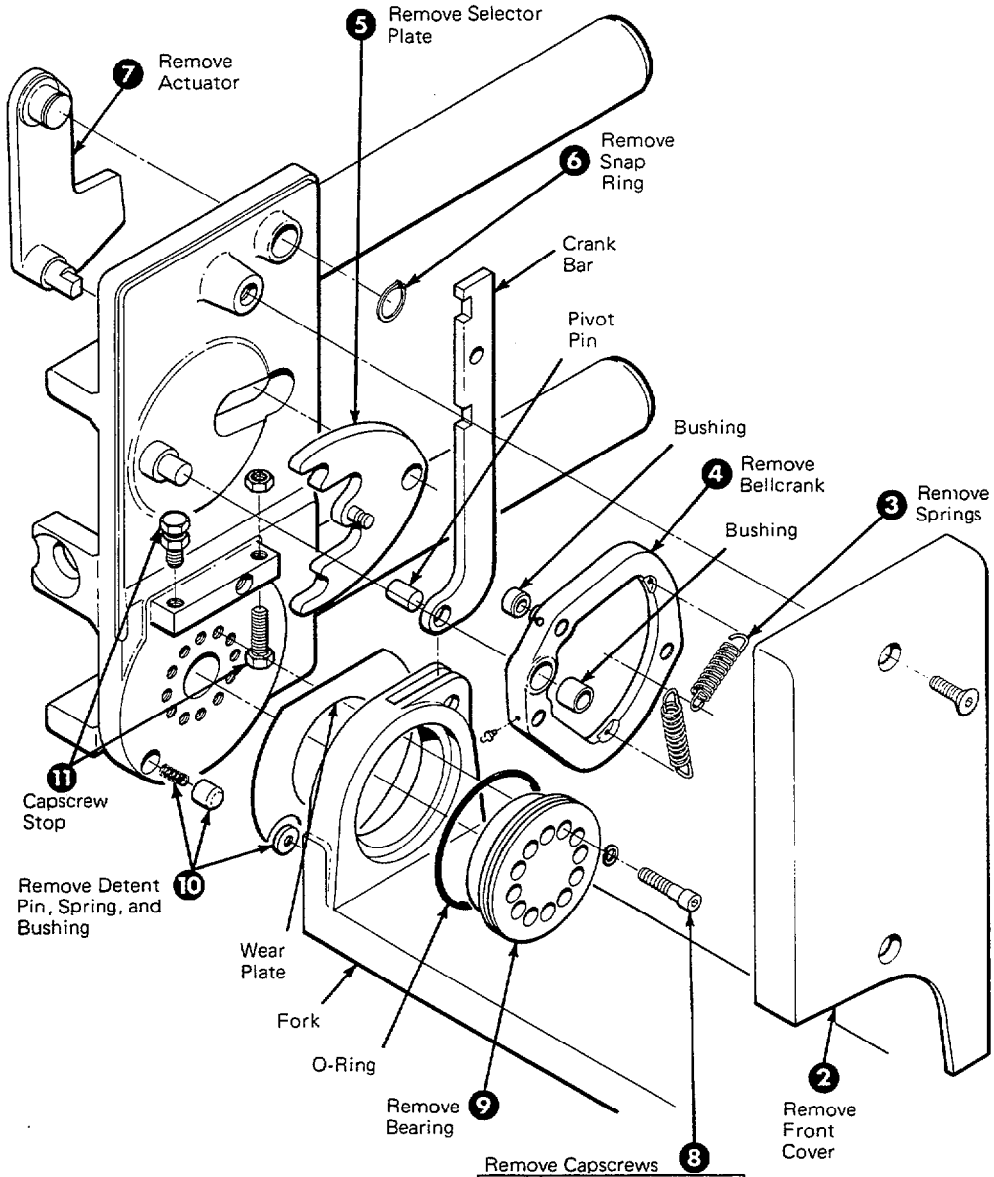
The arms can be disassembled with the attachment mounted on the truck and with the arm carriers installed on the attachment frame. To disassemble an arm:

1. Open the arms so they extend beyond the attachment frame.
2. Remove the front cover to expose the indexing mechanism.

   CAUTION: To index the arm with the cover removed, fabricate and install a bar that spans the front cover capscrew holes that will secure the indexing mechanism.
3. Remove the two springs in the center of the bellcrank.
4. Remove the bellcrank.
5. Push the vertical crank bar aside and remove the selector plate.
6. Remove the snap ring that secures the actuator.
7. Remove the actuator.
8. To remove the fork, remove the twelve socket head capscrews retaining the circular arm bearing. For installation, tighten to a torque of 120—130 ft.-lbs.
9. Press the bearing out of the arm manually.
10. Remove the detent pin, spring, and bushing.
11. For reassembly, reverse the above procedures, except for the following special instructions.

- The two capscrew stops should be adjusted so the arm stops at a true horizontal and vertical position when it is indexed. In the vertical (clamp) position, the capscrew should stop the arm so it just engages the detent pin in the arm base. Tighten the nut to a torque of 85—90 ft.-lbs.
- Lubricate the arm bearing when reassembling.
- Make sure the arm turns freely on the bearing.
- Lubricate the bellcrank fittings with SAE 90 grease.





5.2-4 Turnafork Arm Service

- Inspect all components and bushings for wear. Replace bushings if the ID is scored or a concentration of wear is visible. Replace any components with visible wear where they contact other components.
- Replace the O-ring on the arm bushing each time it is removed.
- Inspect the detent pin, spring, bushing, and seat each time the arm bearing is removed. Replace any part if a concentration of wear is visible.

5.2-5 Turnafork Arm Indexing

Fully closing the arms depresses the actuators. This releases the locking mechanism and causes the arms to change position. If the arms get out of phase, correct the problem as follows:

IMPORTANT: If the arms ever get out of phase, there may be nothing mechanically wrong with the attachment. This condition usually occurs when both actuators are not fully depressed.

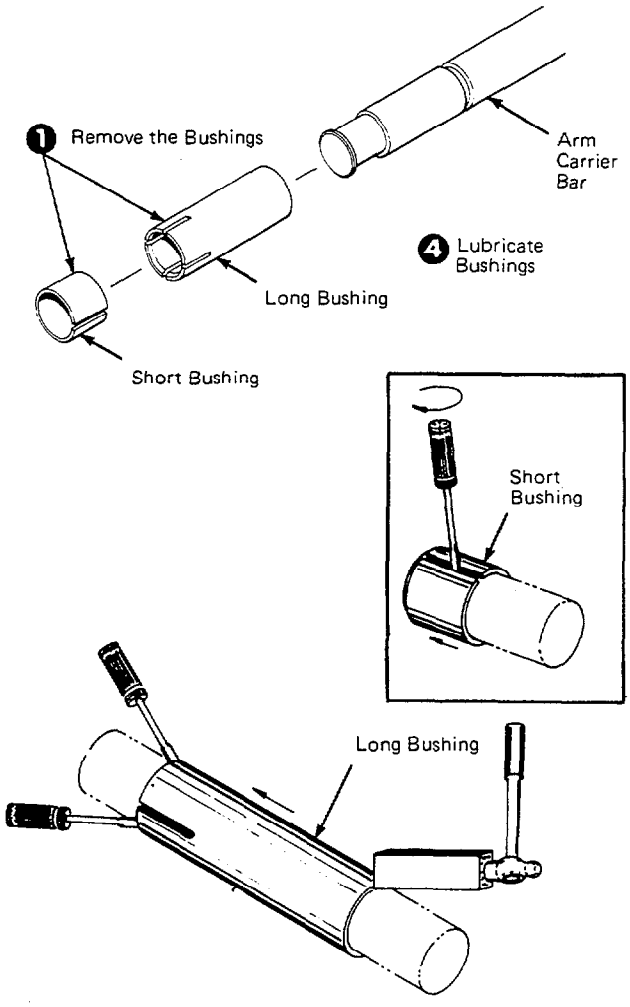
To reposition an arm manually: With the arms fully closed (actuators fully depressed), reposition one arm by hand.

To reposition an arm hydraulically: Close the arms hydraulically (actuators fully depressed). Then open the arm **slowly** until you hear one click. Immediately close the arms together again to bring them back in phase.

5.2-6 Sliding Arm Bushing Replacement, Two-piece Style

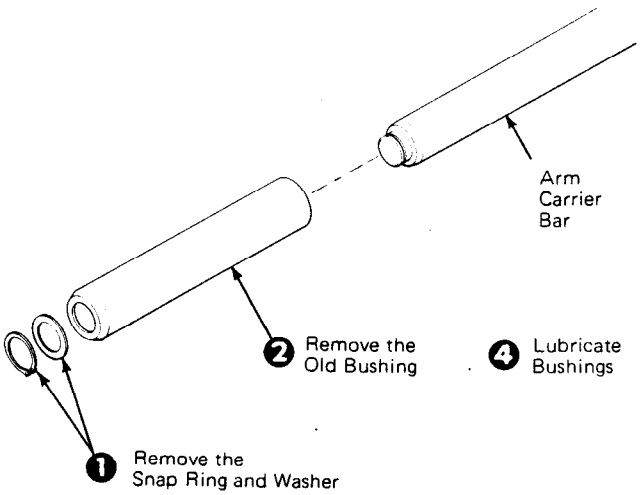
NOTE: An attachment with two-piece bushings may be converted to the new style, one-piece configuration by the installation of the appropriate One-Piece Bushing Conversion Kit. Contact Cascade Customer Service for information.

1. Remove and discard the old long and short bushings. To ease removal, spread the short bushing by inserting a screwdriver blade into the bushing slot. Similarly, insert two screwdrivers into two opposing slots in the long bushing to disengage the bushing retaining lip. It may be necessary to drive off the long bushing with a block and a hammer.
2. Install the long bushing. Spread the slots of the bushing with screwdrivers as during removal. If the bushing will not go over the arm carrier bar, heat it in boiling water for 3 or 4 minutes to soften it. Make sure the bushing retaining lip engages the groove in the arm carrier bar.
3. Install the short bushing. Spread the bushing to ease installation. Make sure the bushing fits into the outermost groove in the arm carrier bar.
4. Lubricate the bushings with a graphite base grease before assembling arm carriers onto the attachment.



5.2-7 Sliding Arm Bushing Replacement, One-piece Style

1. Remove the bushing retainer snap ring and washer from the end of the arm carrier bar.
2. Slide off the old bushing.
3. Slide the new bushing on and install the washer and retaining snap ring.
4. Lubricate the bushings with a graphite base grease before assembling arm carriers onto the attachment.



5.3 Cylinders, General Procedures

5.3-1 Cylinder Removal and Installation

1. **REVOLVING CLAMPS ONLY:** Rotate the attachment so the arms are positioned side-by-side.
2. Extend the arms past the width of the frame.
3. Remove the cylinder rod anchor nuts.

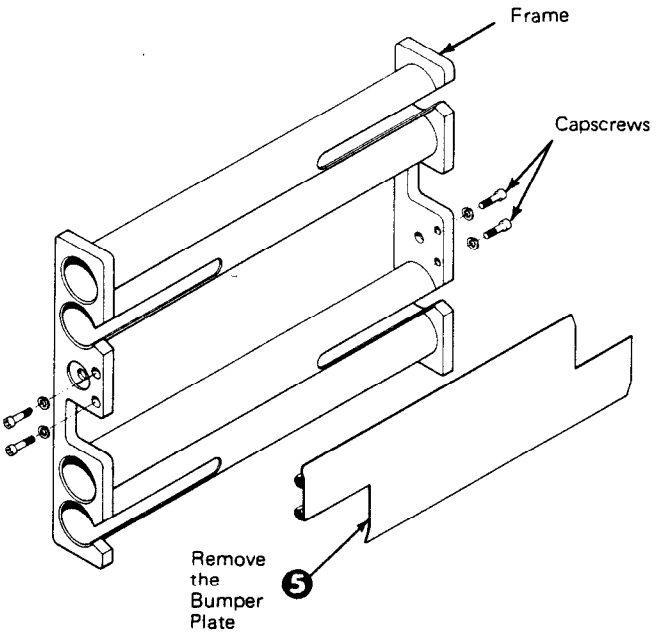
   IMPORTANT: Refer to the procedures pertaining to cylinder anchor nuts as described in Paragraph 5.2-1, Step 2.
4. Retract the cylinder rods until they come out of engagement with the arm lugs.

   CAUTION: Rods will drop as soon as they disengage the frame. Protect the rod surface.
5. Remove the bumper plate.

> **WARNING:** Before removing any hoses, relieve pressure that might be present in the hydraulic system. With the truck off, open the truck auxiliary control valves several times in both directions.

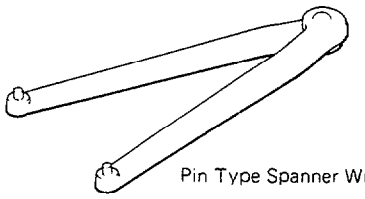
6. Remove and tag the hoses to the cylinders. Cap the hoses and the cylinder ports.
7. Remove the cylinder shell anchor nuts (Paragraph 5.2-1, Step 2).
8. Lift the cylinders away from the clamp frame.
9. Installation is a reverse of removal.

   IMPORTANT: Refer to the procedures pertaining to anchor nuts, Paragraph 5.2-1, Step 6.
10. Operate the attachment through several full cycles to force air in the system to the truck hydraulic tank. Check for leaks.



5.3-2 Cylinder Disassembly

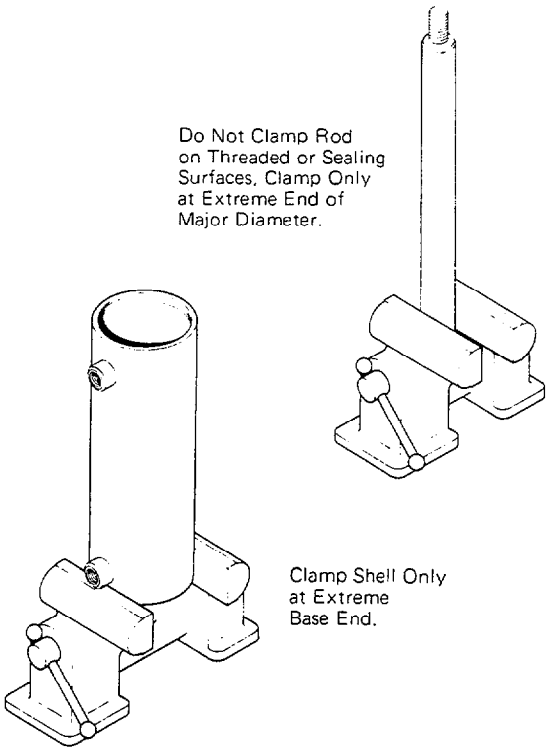
- Use a pin-type spanner wrench to remove cylinder retainers.
- When servicing a cylinder, clamp it in a soft-jawed vise. Clamp the cylinder and the rod on the major diameter at the extreme end only. **Never clamp the cylinder rod sealing surface.**
- V-seals will slide off the piston easily. To gain access to the rod seals, remove the self-adjusting brass bushing from the retainer after the retainer has been removed.
- To remove a U-cup seal from a piston, put the piston in a soft-jawed vise. Pry the seal up with a blunt tool such as a screwdriver, then cut the seal to remove it. Be careful not to scratch the seal groove.


Pin Type Spanner Wrench

5.3-3 Cylinder Inspection

- Inspect the rod, piston, and retainer for nicks or burrs. If deeply gouged, replace the part. Minor nicks and burrs can be removed with an emery cloth.

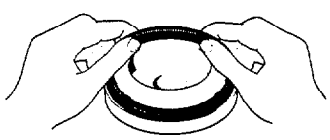
  NOTE: A minor nick is one that will not cause a bypass of oil when the cylinder is operating.
- Inspect the inside of the cylinder shell and remove any minor nicks and burrs (see Note, above) with a butterfly hone. Replace the cylinder shell if it is deeply gouged.
- On cylinders with V-seals, inspect the self-adjusting brass bushing that fits inside the retainer. If the ID is scored, the bushing should be replaced.


Do Not Clamp Rod on Threaded or Sealing Surfaces, Clamp Only at Extreme End of Major Diameter.
Clamp Shell Only at Extreme Base End.

5.3-4 Cylinder Reassembly

- Lubricate all new seals before installing. Use a mixture of petroleum jelly and hydraulic oil.
- Carefully note the direction of seals. If they are installed backwards, the seals will not seal properly. Refer to the illustration of the cylinder you are servicing.
- When installing U-cup seals onto a piston, hook one side of the seal in the groove and push it over the piston.

  NOTE: Polishing the chamfer angle will allow the seal to slide into the groove much easier.
- Always reassemble the rod assembly by sliding the retainer on first, then the piston assembly. Install and torque the piston retaining nut before sliding the rod assembly back into the shell.
- When reassembling a cylinder, always observe all torque values as shown on the appropriate illustration.

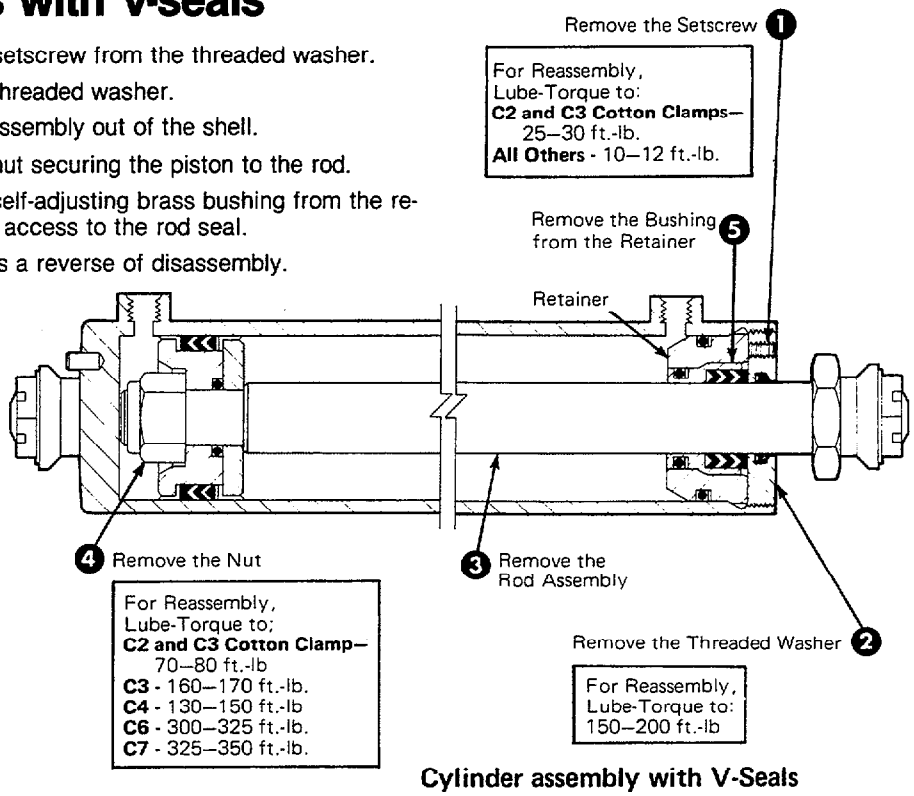


5.4 Cylinder Service

Read the General Procedures, Paragraph 5.3, before proceeding.

5.4-1 Cylinders with V-seals

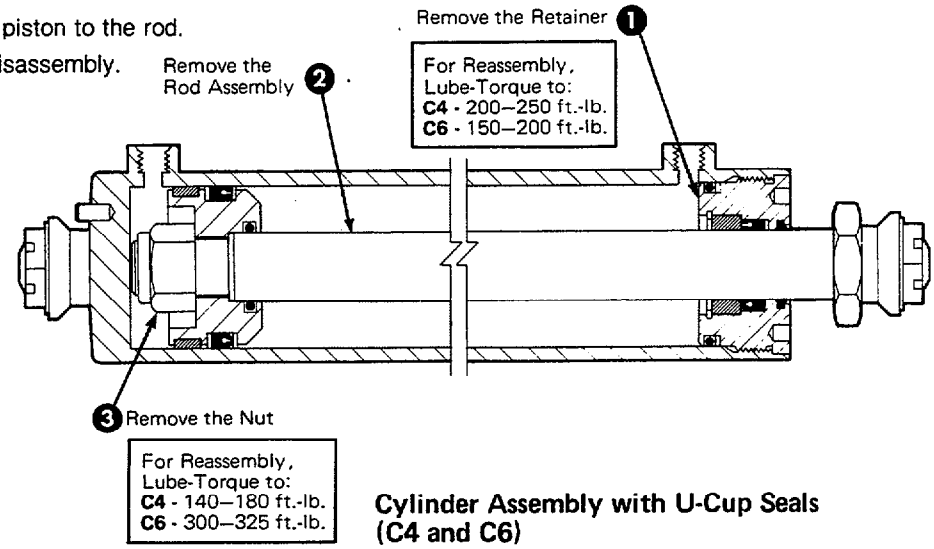
1. Remove the setscrew from the threaded washer.
2. Remove the threaded washer.
3. Pull the rod assembly out of the shell.
4. Remove the nut securing the piston to the rod.
5. Remove the self-adjusting brass bushing from the retainer to gain access to the rod seal.
6. Reassembly is a reverse of disassembly.


Remove the Setscrew 1
For Reassembly, Lube-Torque to:
C2 and C3 Cotton Clamps– 25–30 ft.-lb.
All Others - 10–12 ft.-lb.
Remove the Bushing from the Retainer 5
Retainer
4 Remove the Nut
For Reassembly, Lube-Torque to;
C2 and C3 Cotton Clamp– 70–80 ft.-lb
C3 - 160–170 ft.-lb.
C4 - 130–150 ft.-lb
C6 - 300–325 ft.-lb.
C7 - 325–350 ft.-lb.
3 Remove the Rod Assembly
Remove the Threaded Washer 2
For Reassembly, Lube-Torque to: 150–200 ft.-lb

Cylinder assembly with V-Seals

5.4-2 Cylinders with U-cup Seals

1. Remove the retainer.
2. Pull the rod assembly out of the shell.
3. Remove the nut securing the piston to the rod.
4. Reassembly is a reverse of disassembly.


Remove the Retainer 1
Remove the Rod Assembly 2
For Reassembly, Lube-Torque to:
C4 - 200–250 ft.-lb.
C6 - 150–200 ft.-lb.
3 Remove the Nut
For Reassembly, Lube-Torque to:
C4 - 140–180 ft.-lb.
C6 - 300–325 ft.-lb.

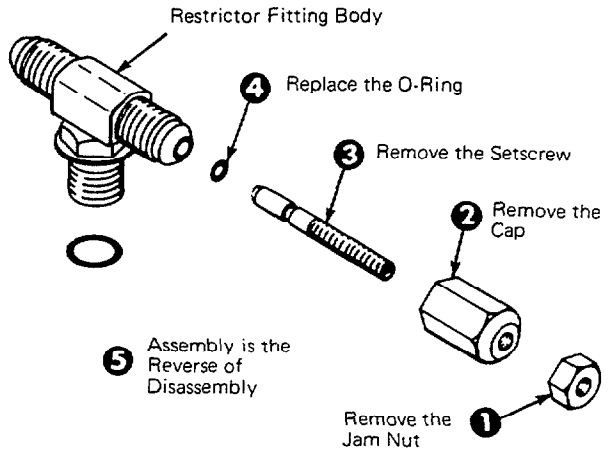
Cylinder Assembly with U-Cup Seals (C4 and C6)

5.5 Restrictor Fittings, Sideshifting Clamps (including Turnafork) Only

An adjustable restrictor fitting is installed in the port of a cylinder to control the flow of hydraulic oil, and, therefore, arm speed.

5.5-1 Restrictor Fitting Service

> **WARNING:** Before disassembling a restrictor fitting, relieve pressure that might be in the hydraulic system. With the truck off, open the truck auxiliary control valves several times in both directions.



1. Remove the jam nut from the setscrew.
2. Remove the cap from the restrictor fitting body.
3. Unthread and remove the setscrew.
4. Replace the O-ring.
5. For assembly, reverse the above procedures. Lubricate the O-ring.

5.5-2 Restrictor Fitting Adjustment

Restrictor fittings should be adjusted so that when one arm bottoms during opening or closing, the other arm is no more than 2 inches from bottoming. Before adjusting, make sure the truck hydraulic system provides the specified volume output as follows:

Volume: **Basic Clamps, Sideshifting Clamps, and Turnafork**—5-20 gpm
Revolving Clamps—Required volume to obtain rated rotation speed specification:
C2R, C3R—10 gpm
C4R—15 gpm
C6R—20 gpm
C7R—20 gpm

NOTE: If you have questions concerning these ratings, call Cascade's Service Department, toll-free, 800-547-5266.

To adjust:

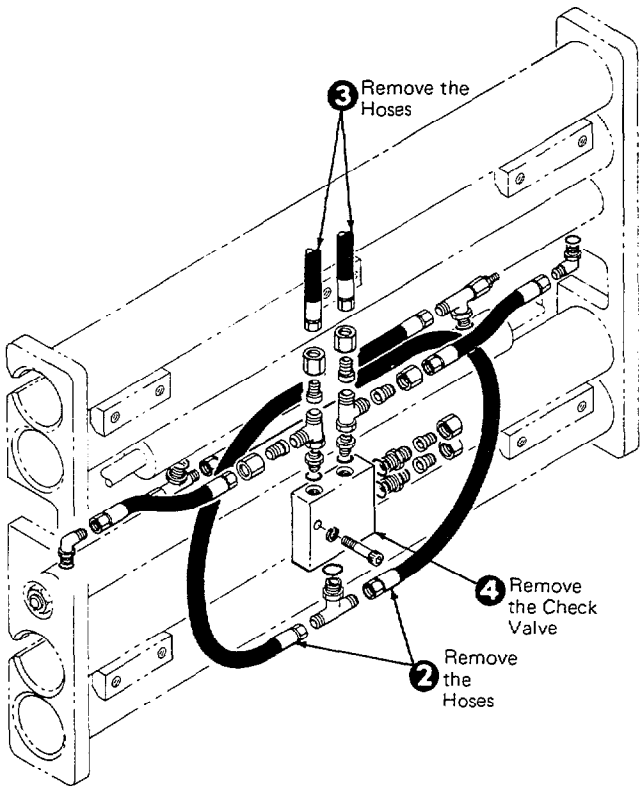
1. Loosen the jam nut on each restrictor fitting.
2. Screw both setscrews in until they bottom, then back off two full turns.
3. Operate the attachment to determine which arm is moving slower.
4. Back off the setscrew on the slower arm until arm speed is equalized.
5. Back off both setscrews equally until desired arm speed is achieved without losing equalization.
6. While holding the setscrew with a screwdriver, tighten the jam nuts.

5.6 Check Valve, Basic Clamps, Sideshifting Clamps, and Turnaforks Only

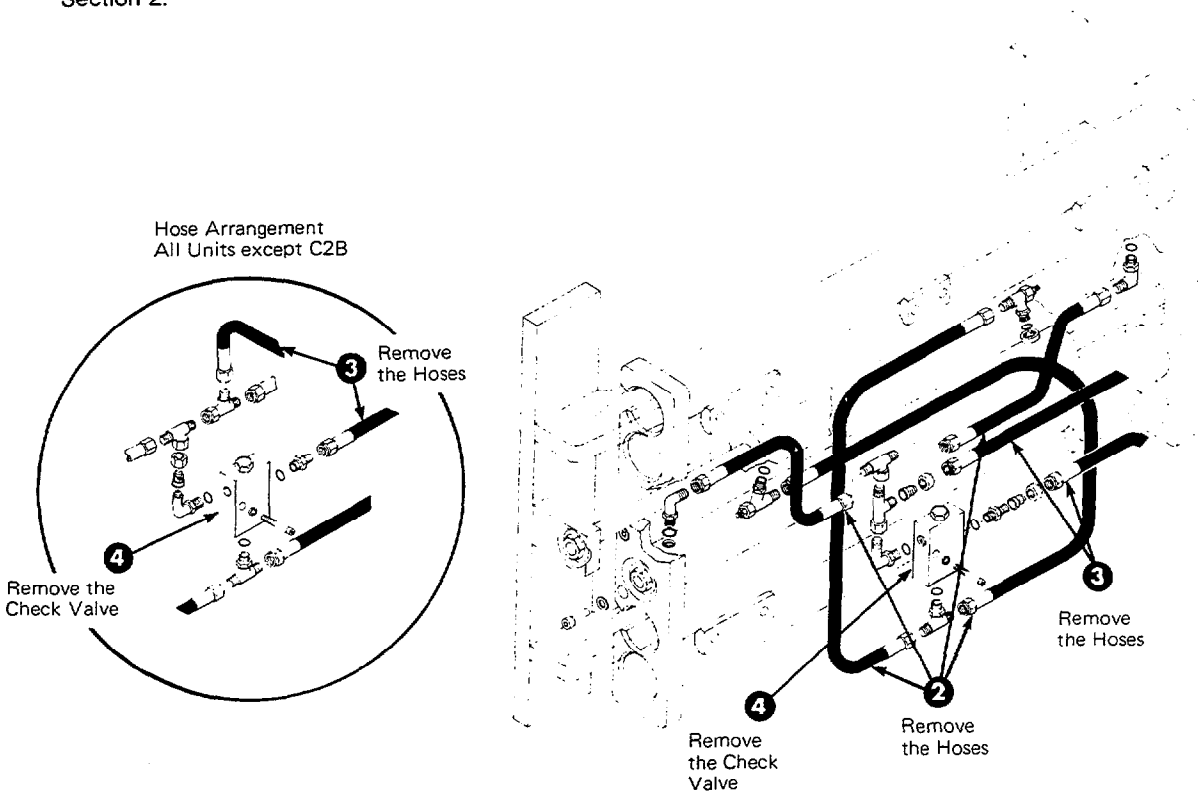
The check valve assembly on basic clamps has a single pilot-operated check valve. The check valve assembly on sideshifting clamps and Turnaforks have three pilot-operated check valves.

5.6-1 Check Valve Removal and Installation

1. Remove the attachment from the truck as described in Paragraph 5.1.
2. Remove, cap, and tag the cylinder supply hoses to the check valve.
3. Remove, cap, and tag the truck hoses to the check valve.
4. Remove the check valve by removing the capscrew securing the valve to the attachment frame.
5. Installation of the check valve is a reversal of removal.
6. Install the attachment onto the truck as described in Section 2.



Sideshifting Clamps



Basic Clamps

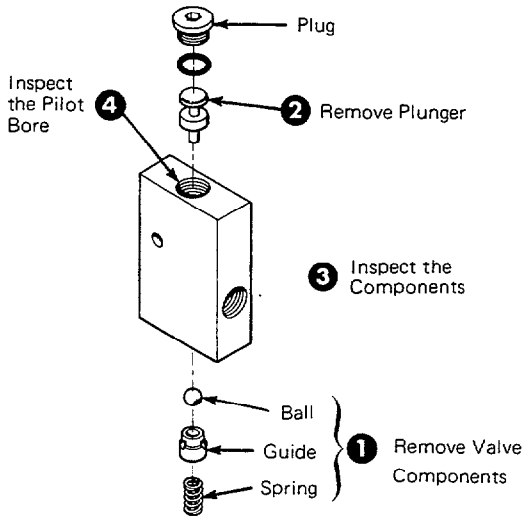
5.6-2 Check Valve Service

IMPORTANT: Service the check valve in a clean work area.

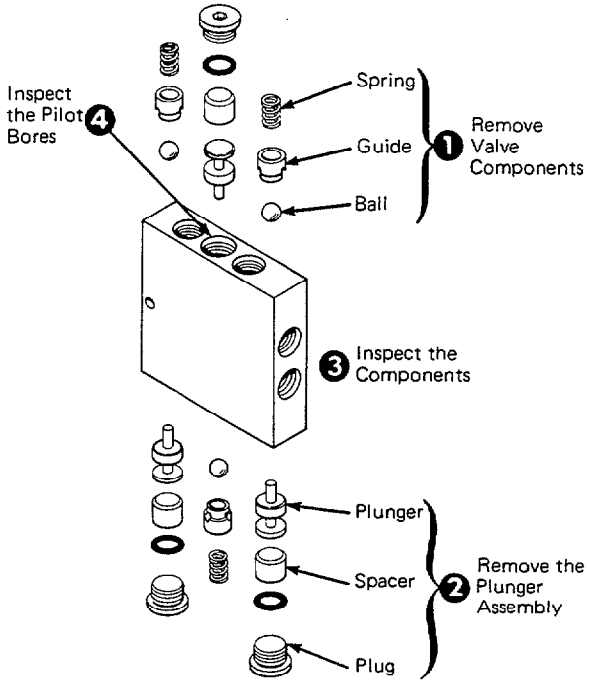
1. Remove the hose fittings from the valve body and remove the balls, guides, and springs. Clean the parts.
2. Remove the allen-head plugs and remove the plungers and spacers. Clean the parts.
3. Inspect all parts. Worn guides and plungers, weak or broken springs, and nicked balls should be replaced.
4. Inspect the pilot bores. They should be smooth and free of scoring.
5. With the ball and seat **only** in place, attach a hose from the truck junction block to each ball port and test for leakage.

> **WARNING:** Examine the pilot bores with a mirror to avoid the possibility of getting oil in the face.

6. Pressurize the line and examine each pilot bore for leakage. If there is no leakage, reassemble the check valve. If leakage is present, remove the hose and reseat the balls by tapping them into their seats with a brass punch. Retest. If the balls cannot be reseated, the valve must be replaced.
7. Reassembly of the check valve is a reversal of disassembly.



Basic Clamp Check Valve



Sideshifting Clamp Check Valve

5.7 Revolving Connections, Revolving Clamps Only

The revolving connection has two cartridge valves located in the valve body.

5.7-1 Revolving Connection, Cartridge-type Check Valve Service

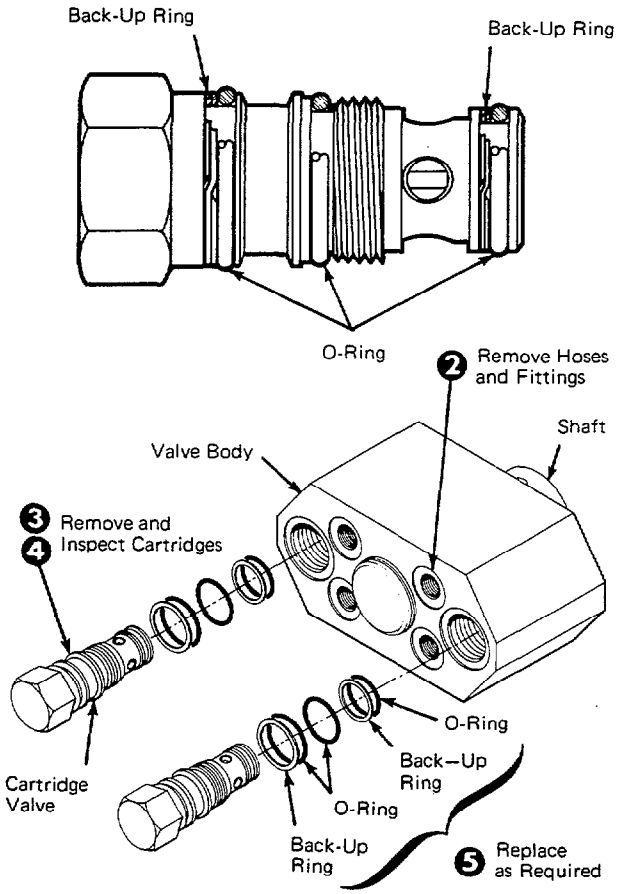
The following procedures can be performed with the attachment on the truck.

1. Remove the cylinders as described in Paragraph 5.3-1.
2. Remove the four supply hoses and fittings from the front of the revolving connection valve body.
3. Remove the two hex-head cartridge valves on the front of the revolving connection. Thoroughly clean the parts.
4. Inspect the cartridge valve assemblies for cut or defective external O-rings.

   NOTE: Internal cartridge valve components are not serviceable.
5. Replace O-rings and backup rings as required.

   CAUTION: Backup rings must be wound as shown to avoid seal damage during cartridge installation. O-rings must be installed on the pressure side of the groove.

   If leakage is visible between the shaft and valve body, the shaft seals must be replaced. To replace shaft seals, the revolving connection must be removed from the attachment. Refer to the procedures in Paragraphs 5.7-2 and 5.7-3.
6. Installation of the cartridge valves is a reversal of removal. Before installing each cartridge, lubricate the O-rings.



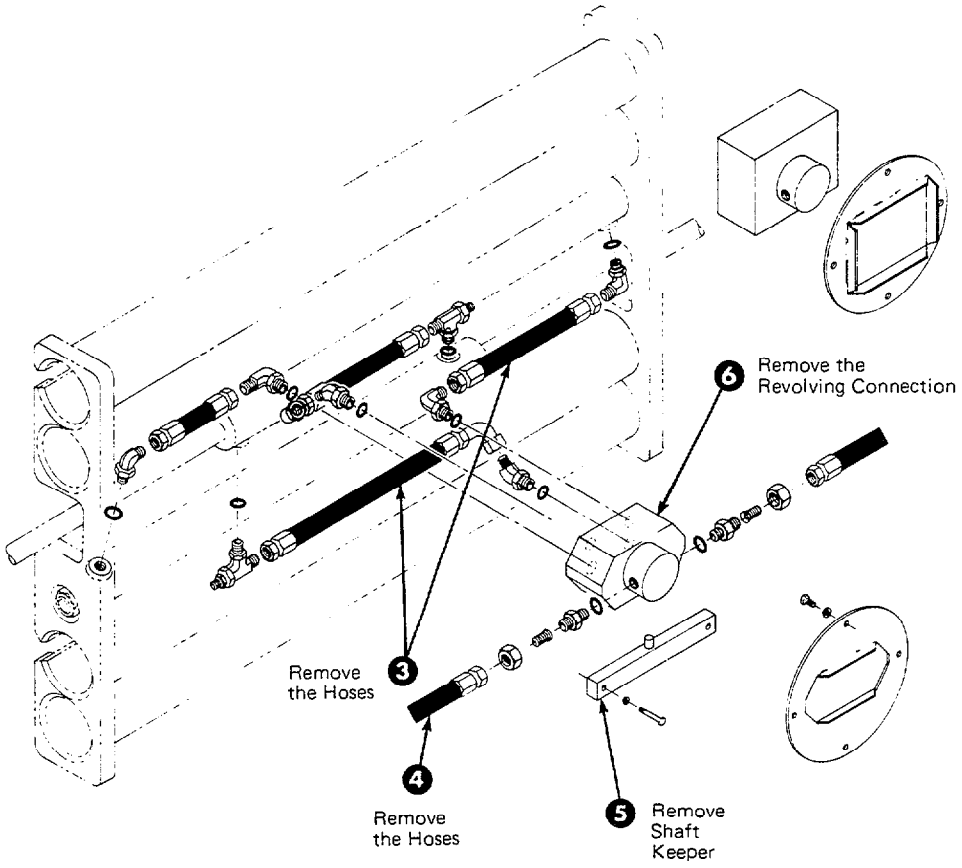
6 Install Cartridge Valves after Lubricating Seals

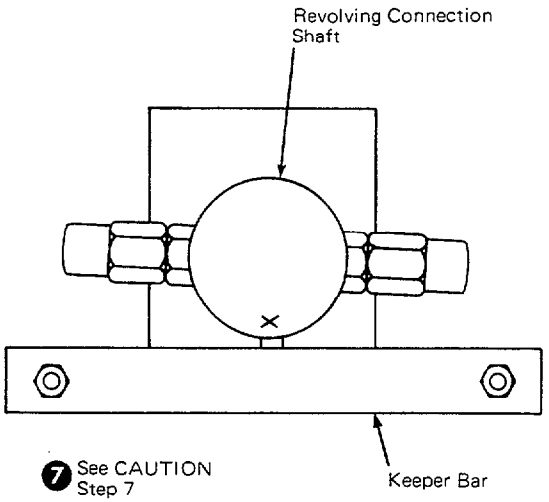
5.7-2 Revolving Connection Removal and Installation

To service the check valves on ball-and-plunger-type revolving connections or to service the revolving connection shaft, the revolving connection must be removed from the attachment.

1. Remove the attachment from the truck as described in Paragraph 5.1.
2. Remove the cylinders as described in Paragraph 5.3-1.
3. Remove, cap, and tag the cylinder supply hoses from the revolving connection valve body.
4. Remove, cap, and tag the truck hoses to the revolving connection shaft, extending out the back of the attachment.
5. Remove the shaft keeper bar.
6. Pull the revolving connection out of the attachment.
7. Installation of the revolving connection is a reversal of removal.

   CAUTION: ALL UNITS EXCEPT C7R. The shaft locating hole marked "X" must be engaged by the horizontal keeper bar.
8. Install the attachment onto the truck as described in Section 2.





5.7-3 Revolving Connection Service

IMPORTANT: Service the revolving connection in a clean work area.

1. Remove the snap ring(s) from the revolving connection shaft.
2. Remove the shaft from the body.

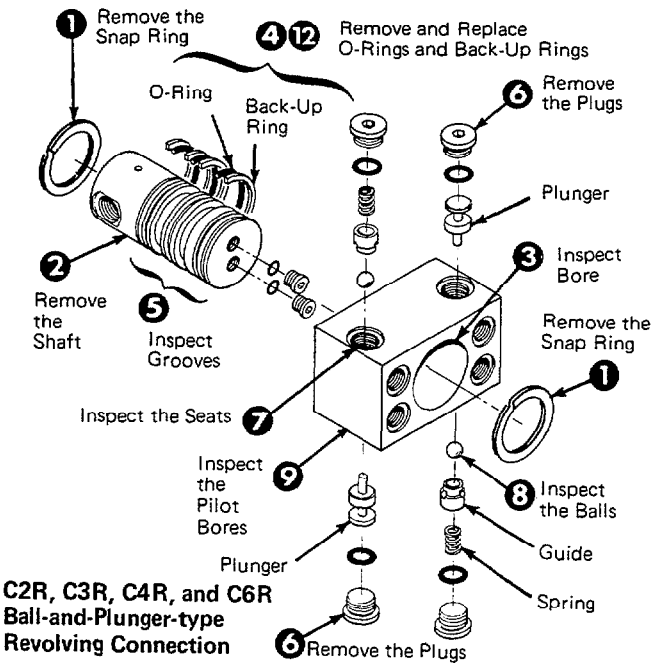
   CAUTION: Remove any paint or burrs from the shaft end and snap ring groove(s) before pulling the shaft out of the valve body to prevent damage to the valve.
3. Clean the parts and inspect the shaft bore for scoring. If the bore is scored, the valve body must be replaced.
4. Note the position of the O-rings and backup rings, then remove them from the valve shaft. Be careful not to scratch the grooves.
5. Check the shaft grooves for rough edges or scratches. Remove minor imperfections with fine emery cloth. If the scratches cannot be removed, replace the shaft.

   NOTE: A minor imperfection is one that will not cause a bypass of oil when the revolving connection is operating.
6. Service cartridge-type check valves as described in Paragraph 5.7-1. To service ball-and-plunger-type check valves, remove the plugs or hose fittings securing the ball checks and the plungers. Remove the balls, springs, guides, and plungers. Thoroughly clean the parts.
7. Inspect the valve seats for scoring or elongation. The valve seats can be reseated by tapping a ball into its seat with a brass punch. If the seat cannot be reseated, the valve must be replaced.
8. Inspect the balls for nicks and scratches.
9. Inspect the pilot bores. They should be smooth and free of scoring. If you cannot smooth minor irregularities with an emery cloth, replace the valve.
10. With the ball and seat **only** in place, attach a hose from the truck junction block to each ball port to test for leakage.

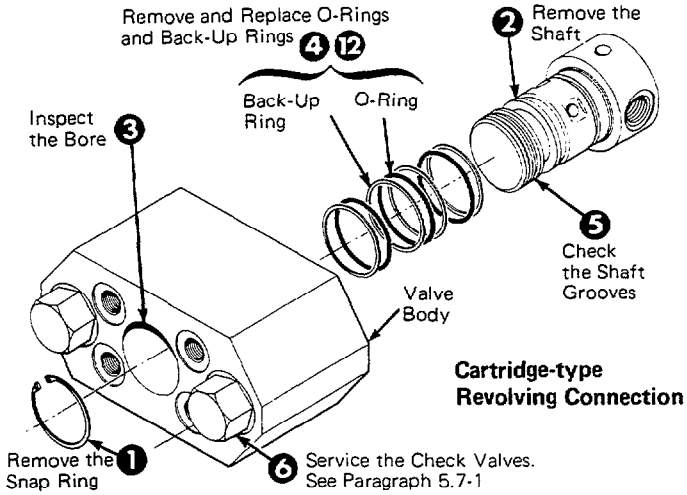
> **WARNING:** Examine the pilot bores with a mirror to avoid the possibility of getting oil in the face.

11. Pressurize the line and examine each pilot bore for leakage. If there is no leakage, reassemble the check valves. If leakage is present, remove the hose and reseat the balls by tapping them into their seats with a brass punch. Retest. If the balls cannot be reseated, the valve must be replaced.
12. Install new O-rings and backup rings on the revolving connection shaft. Be careful not to distort the seals.
13. Reassembly of the revolving connection is a reversal of disassembly. Lubricate the shaft O-rings to ease reassembly. Rotate the shaft into the body to prevent "rolling" the O-ring seals. Be careful not to damage the valve bore.

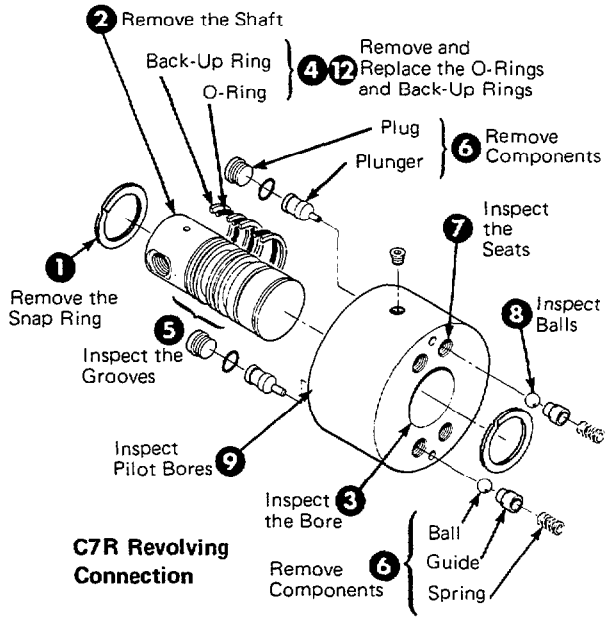
    NOTE: Ball-and-plunger-type revolving connection valve bodies and shafts are not available as replacement parts. They must be replaced by cartridge-type revolving connections, which are interchangeable with ball-and-plunger types.



C2R, C3R, C4R, and C6R Ball-and-Plunger-type Revolving Connection


Remove and Replace O-Rings and Back-Up Rings 4 12
2 Remove the Shaft
Back-Up Ring
O-Ring
Inspect the Bore 3
5 Check the Shaft Grooves
Valve Body
Remove the Snap Ring 1
6 Service the Check Valves. See Paragraph 5.7-1

Cartridge-type Revolving Connection



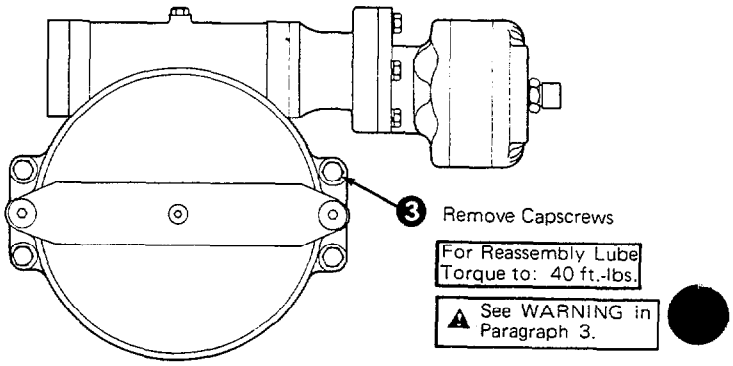
C7R Revolving Connection

5.8 Rotator Drive Group, Revolving Clamps Only

Your attachment may be equipped with either a cushioned rotator drive group or an uncushioned unit. Cushioning is achieved by the installation of cone-shaped spring washers on both sides of the worm, powered by the rotator motor. The worm gear is in mesh with the rotator ring gear. Therefore, shock loads applied to the attachment arms are transferred to the worm through the worm gear and are absorbed by the spring washers.

All revolving clamps have a single drive group except the C7R, which has a dual drive unit. Special procedures for C7R models are noted in the following.

5.8-1 Rotator Drive Group Removal and Installation



1. Remove the attachment from the truck as described in Paragraph 5.1.
2. **C7R Models only.** Remove the four capscrews securing the two halves of the cover over the dual drive coupling and remove both cover halves. Then remove the chain around the coupling sprockets.
3. Remove the rotator gear drive case retaining capscrews and remove the gearcase(s) from the attachment baseplate.

> **WARNING:** With the gear case(s) removed, the baseplate is free to rotate. Keep clear of the baseplate to avoid being pinched.

4. **C7R Models only.** Remove the coupling sprockets from the worm shaft of each drive group.
5. Service the rotator drive group as described in Paragraphs 5.8-2 and 5.8-3.
6. Reinstallation of the rotator drive group is a reverse of removal, except the C7R. Perform the following Steps 7 through 16 to synchronize the C7R dual drive group.
7. Install the circular seal (located in the coupling cover) over one sprocket hub. The lip of the seal should face the sprocket teeth. Leave the felt dust seal in place in the coupling cover.
8. Install the coupling sprockets on the worm shaft of each drive group. Make sure the keys are in place. Don't tighten the setscrews in the sprocket hubs yet.
9. Install both drive groups onto the baseplate.

5.8-1 Rotator Drive Group Removal and Installation (Cont.)

⑩ To synchronize the worm shafts, rotate each sprocket counterclockwise by hand until you feel resistance. Using the uppermost allen-head capscrew on the shaft end cap as a reference, mark one tooth of the sprocket. Then turn the sprocket clockwise, counting the teeth as they pass the allen-head capscrew. Stop turning when you feel resistance. Now rotate the sprocket back counterclockwise **half** the number of teeth counted. The sprockets are now positioned halfway between where you felt resistance.

⑪ Install the chain around the sprockets. If one sprocket does not align with the chain, rotate it no more than 1/2-tooth-width until it does.

⑫ Center the sprockets within 1/8 inch between the drive unit end housings. Tighten the setscrews on both sprocket hubs.

⑬ Coat the chain with Richfield No. 2MP grease or equivalent.

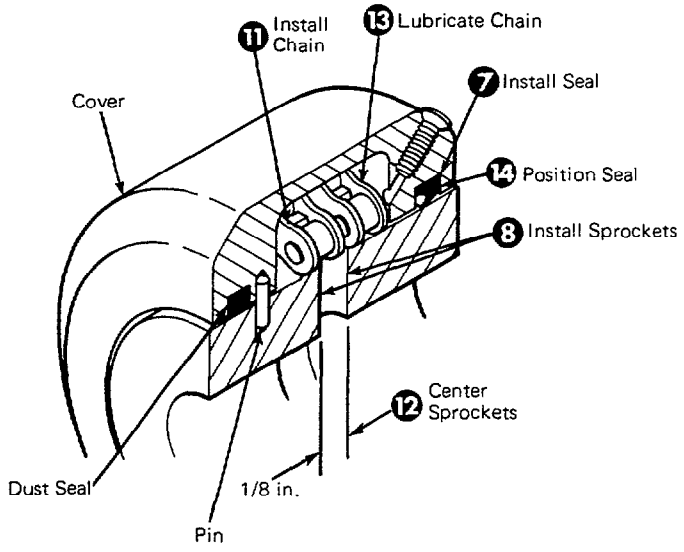
⑭ Position the seal on the sprocket so that it aligns with the grooves in the cover.

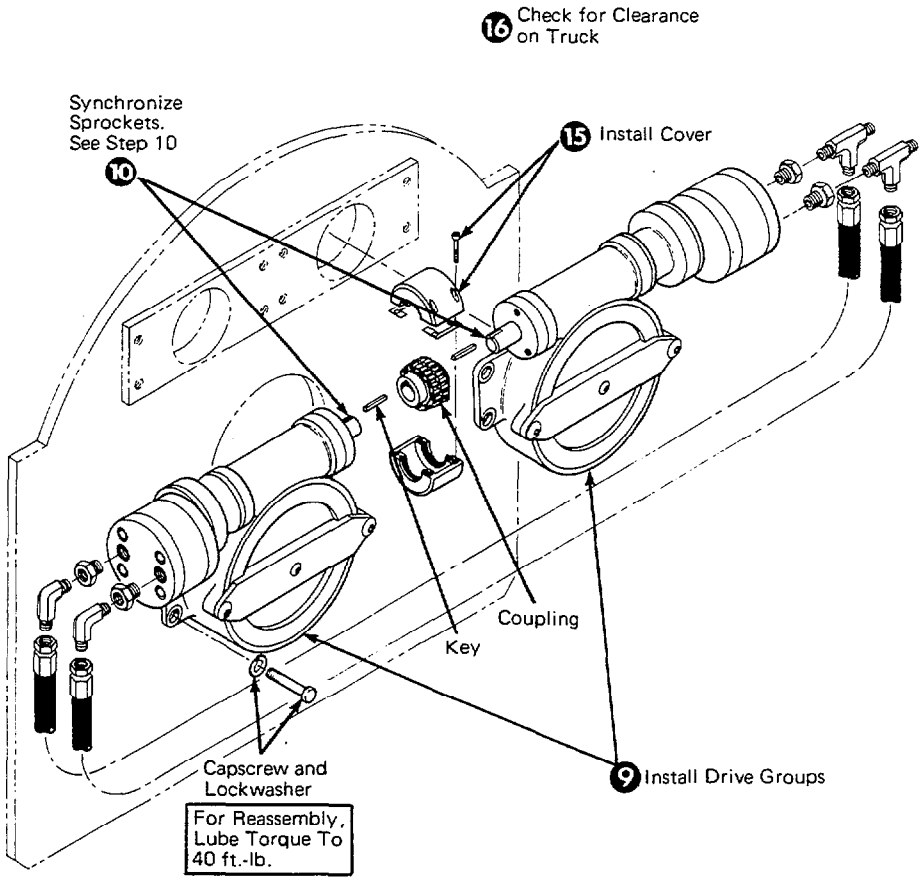
⑮ Install the cover over the sprockets, making sure the seals are in place.

CAUTION: The steel pin on one cover half must align with the hole in the other half before you tighten the screws.

⑯ After the attachment is installed on the truck, power the rotator to check for clearance between the coupling and the baseplate.

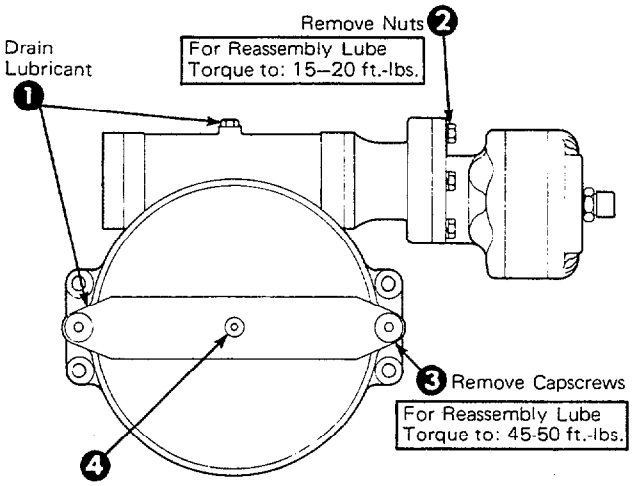
⑰ Install the attachment onto the truck as described in Section 2.

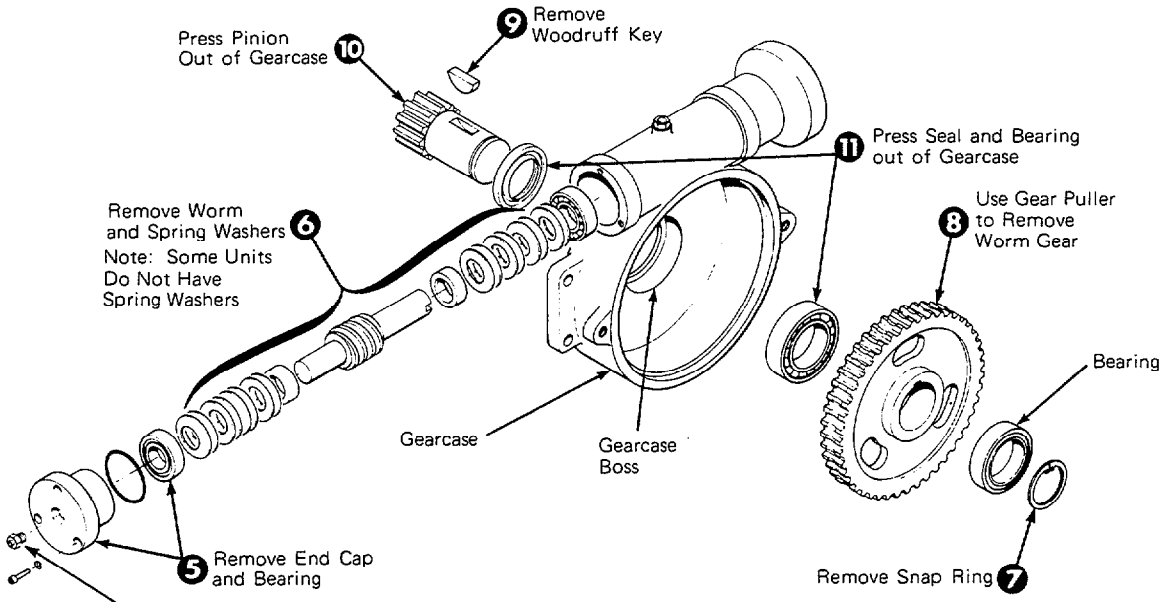




5.8-2 Rotator Drive Group Disassembly and Service

1. Drain the lubricant from the gearcase. Lay the gearcase (pinion down) on 4 X 4's placed on either side of the pinion.
2. Remove the rotator motor as described in Paragraph 5.9-1. Motor service procedures are described in Paragraph 5.9-2.
3. Remove the capscrews retaining the gearcase cover.
4. Remove the capscrew from the center of the cover and replace it with a 3/8-inch-16 UNC capscrew 2 inches long. Turn the capscrew clockwise while lightly tapping the side of the cover with a plastic-head hammer to loosen it.
5. Remove the end cap and bearing.
6. Remove the worm and spring washers (if equipped).
7. Remove the snap ring from the pinion shaft.
8. Using a gear puller, remove the worm gear from the pinion shaft.
9. Remove the Woodruff key from the pinion shaft.
10. Press the pinion out of the gearcase.
11. Press the pinion bearing out of the gearcase.
12. Clean and inspect the components. Replace any item that is worn or galled. Remove any burrs with an emery cloth or small hand grinder.



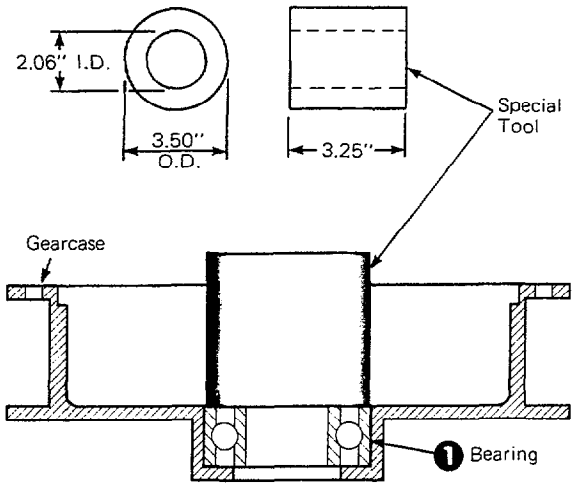


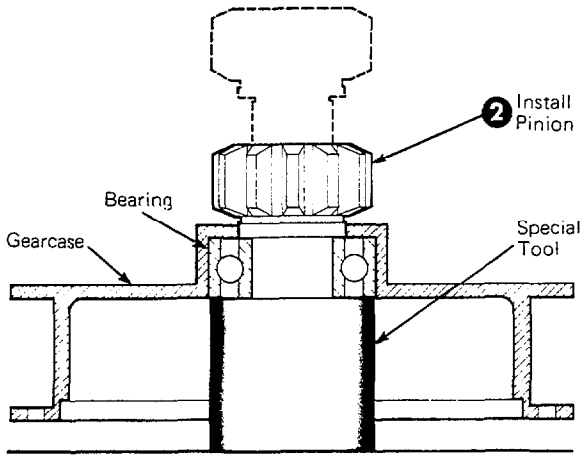
CAUTION: Some units will have this style relief fitting in the end cap. These units may have damaged ball thrust bearings due to low rotator fluid. Cascade has a drive box lube kit available which provides new ball thrust bearings and a new pressure relief fitting. See Technical Bulletin 114 for complete ordering instructions.

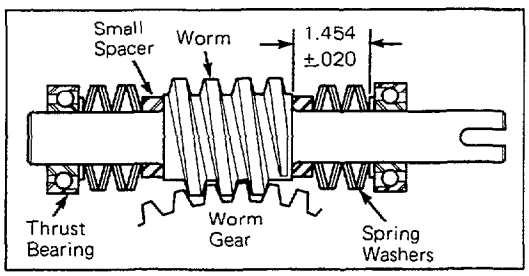
5.8-3 Rotator Drive Group Reassembly

1. Press the bearing into the housing from the inside using the special tool, Cascade part number C-664620. Make sure the bearing is fully seated and flush with the inside of the gearcase.
2. Support the bearing from the inside with the special tool and press the pinion into the bearing from the outside.
3. Install the Woodruff key into the pinion shaft.
4. Press the worm gear onto the pinion shaft, making sure you align it with the Woodruff key.
5. Press the bearing onto the pinion shaft.
6. Install the snap ring.
7. Assemble the spring washers, spacers (if equipped), and ball thrust bearings (See Caution below) on the worm shaft and install in the housing.

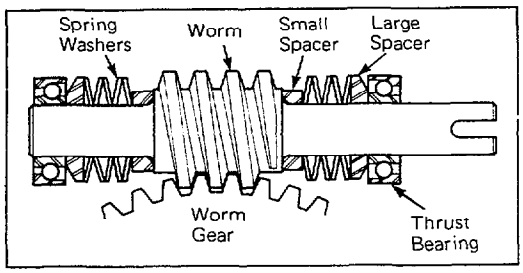
CAUTION: The ball thrust bearing must be assembled on the worm with the thickest portion of the outer race (the side stamped with the manufacturer and part number) facing away from the washers.



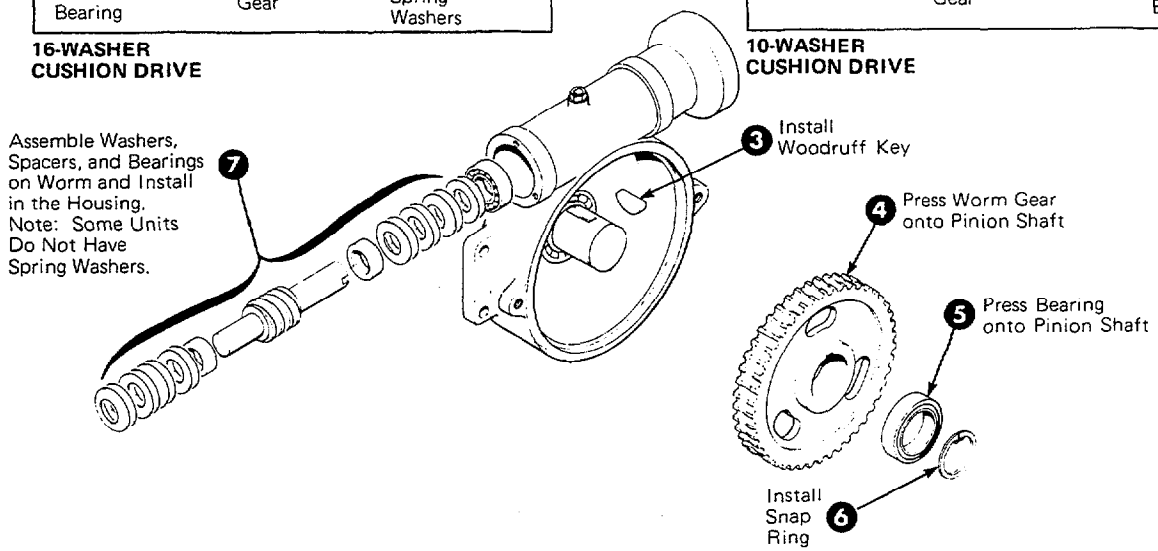




16-WASHER CUSHION DRIVE

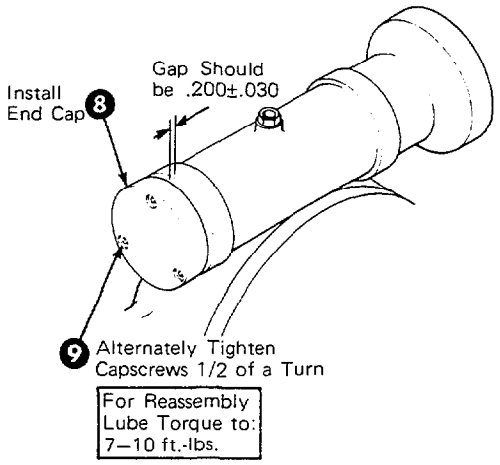


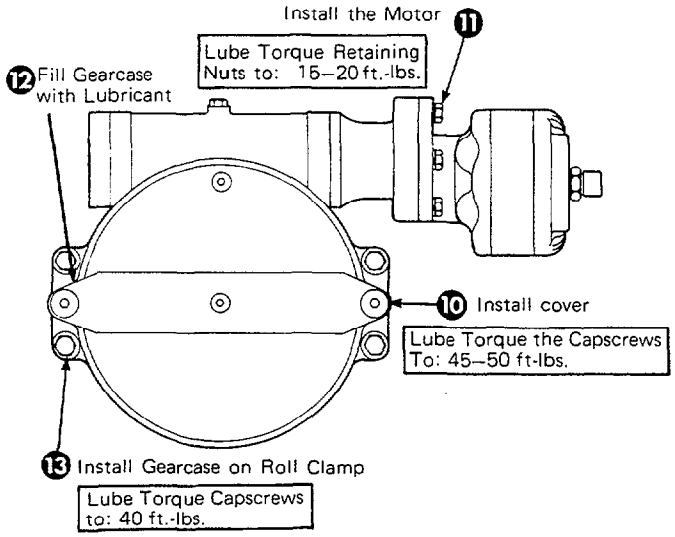
10-WASHER CUSHION DRIVE


Assemble Washers, Spacers, and Bearings on Worm and Install in the Housing. Note: Some Units Do Not Have Spring Washers.
7
3 Install Woodruff Key
4 Press Worm Gear onto Pinion Shaft
5 Press Bearing onto Pinion Shaft
Install Snap Ring
6

5.8-3 Rotator Drive Group Reassembly (Cont.)

8. Install the end cap. If the gap on cushion drive units is greater than that shown, the spring washers are incorrectly stacked. Remove the worm and restack the washers.
9. Alternately tighten the endcap capscrews 1/2 of a turn. Lube torque to 7-10 ft.-lbs.
10. Install the cover.
11. Install the motor.
12. Fill the gearcase with 44 fluid ounces of Cascade Rotator Fluid (Cascade part number C-656300). NOTE: C-656300 = 32 fluid ounces.
13. Install the gearcase onto the attachment baseplate.


Install End Cap 8
Gap Should be .200±.030
9 Alternately Tighten Capscrews 1/2 of a Turn
For Reassembly Lube Torque to: 7–10 ft.-lbs.

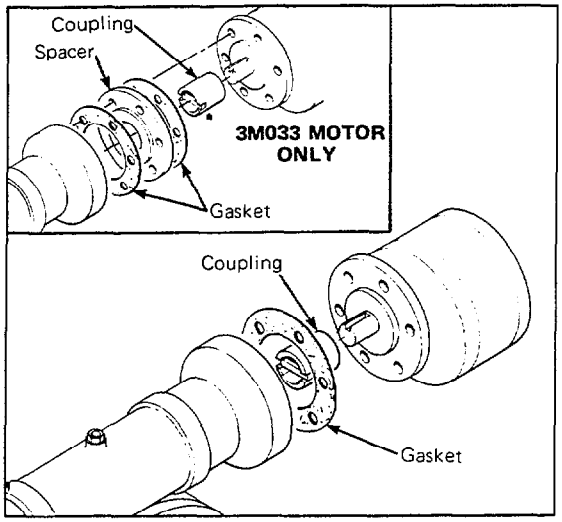

Install the Motor 11
Lube Torque Retaining Nuts to: 15–20 ft.-lbs.
12 Fill Gearcase with Lubricant
10 Install cover
Lube Torque the Capscrews To: 45–50 ft-lbs.
13 Install Gearcase on Roll Clamp
Lube Torque Capscrews to: 40 ft.-lbs.

5.9 Motor

5.9-1 Motor Removal and Installation, Revolving Clamps Only

The rotator motor can be removed for service with the attachment on the truck.

> **WARNING:** Before removing supply hoses, relieve pressure that might be present in the hydraulic system. With the truck off, open the truck auxiliary control valves several times in both directions.



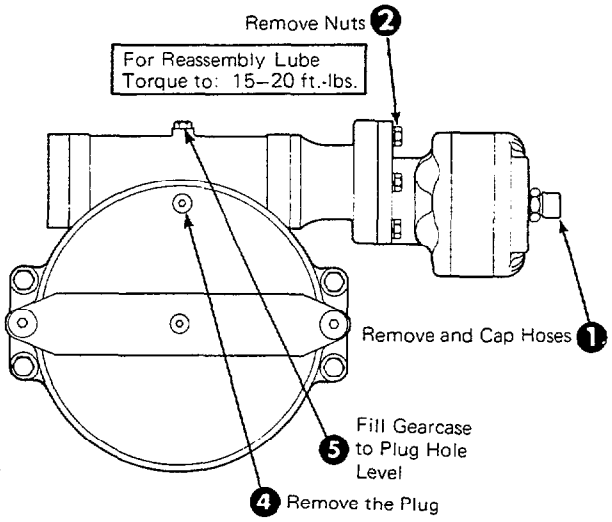
1. Remove, cap, and tag the supply hoses to the motor.
2. Remove the motor from the rotator drive assembly by removing the six retaining nuts. Slide the motor out of engagement and remove the coupling and key from the motor shaft. A small amount of rotator fluid might spill when the motor is removed.
3. Clean the motor and gear case mating surfaces with solvent. Apply LOCTITE 515 sealer to these surfaces.

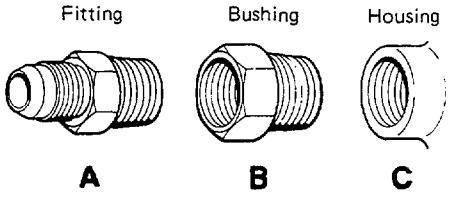
   Install the motor and tighten the retaining nuts to a torque of 15—20 ft.- lbs. (Lubed).

   CAUTION: Because the threaded part on the motor is tapered, overtightening the fitting in the port will split the housing. Fittings should be snug but not overtightened. Install reducers and fittings as follows:

   Thread hose fitting (A) into bushing (B) until tight. Fit the assembly of the bushing and fitting (A + B) into the housing (C). Tighten the bushing (B) **only.** Any attempt to tighten the hose fitting after installation in the bushing may result in a cracked housing.

   CAUTION: If rotator fluid was spilled when the motor was removed, perform the following:
4. Remove the plug at the top of the side cover.
5. Fill the gearcase to the plug hole level with Keystone WG-1 lube (Cascade part no. C-656300). Install the plug.


Remove Nuts 2
For Reassembly Lube
Torque to: 15–20 ft.-lbs.
Remove and Cap Hoses 1
5 Fill Gearcase to Plug Hole Level
4 Remove the Plug

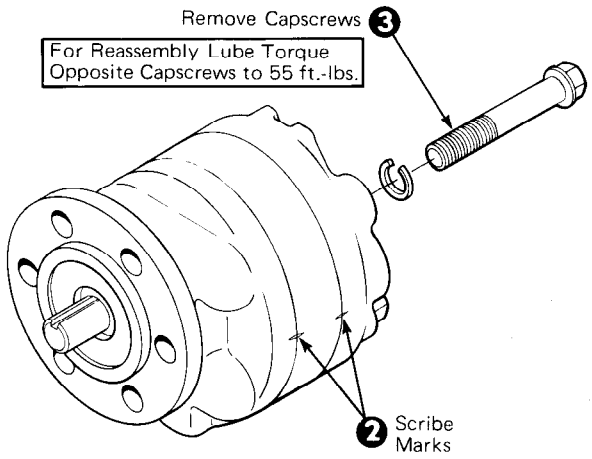


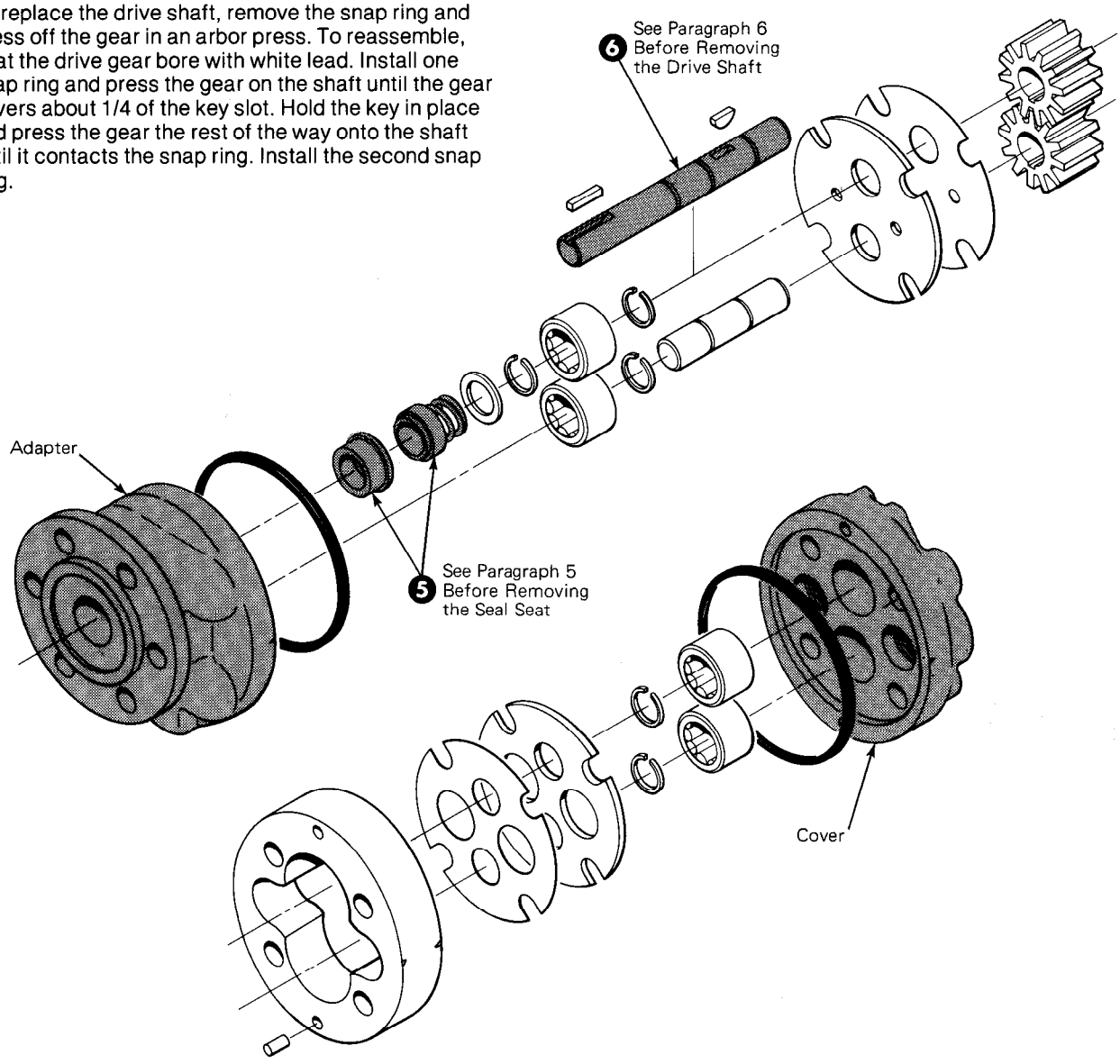
5.9-2 Motor Disassembly and Reassembly

Cascade only services the adapter and cover, the drive shaft and the seal kit which includes the seal seat and seat assembly and the 2 large O-rings. Due to cost, if any other parts need replacement, it is cost effective to replace the complete motor assembly. The instructions below are for replacing the seal kit, drive shaft, adapter and cover only.

IMPORTANT: Service the motor in a clean work area.

1. Clean the outside of the motor and dry thoroughly. Remove any sharp edges or burrs.
2. Mark the sections of the motor with a punch or scribe for matching during reassembly.
3. Remove the four capscrews from the motor cover.
4. With a fibre hammer, tap the cover to loosen and remove it.
5. Inspect the seal seat. Replace only if the sealing face is excessively worn or damaged. Remove it by inverting the adapter and driving out the seat with a wooden block. Press the new seat into the adapter.
6. To replace the drive shaft, remove the snap ring and press off the gear in an arbor press. To reassemble, coat the drive gear bore with white lead. Install one snap ring and press the gear on the shaft until the gear covers about 1/4 of the key slot. Hold the key in place and press the gear the rest of the way onto the shaft until it contacts the snap ring. Install the second snap ring.





5.10 Frame Assembly, Revolving Clamps Only

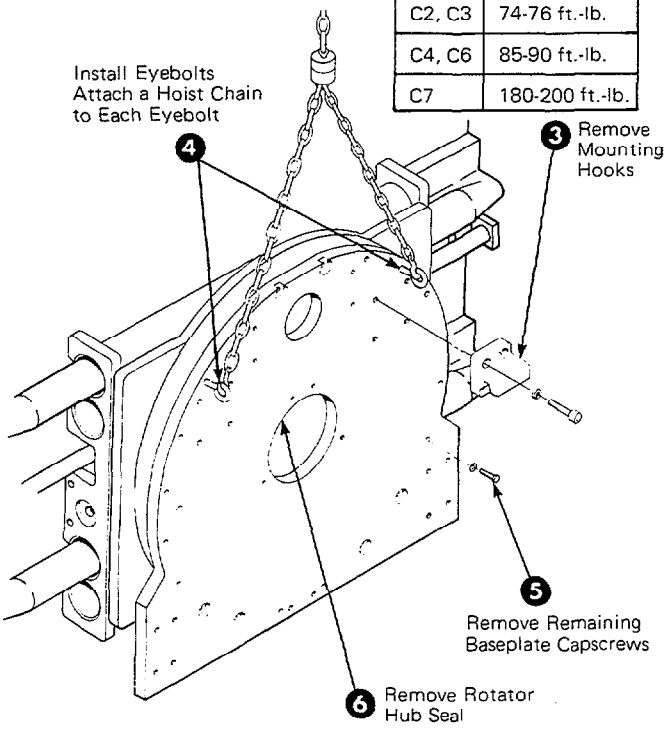
5.10-1 Baseplate Removal

1. Remove the attachment as described in Paragraph 5.1.
2. Remove the revolving connection, Paragraph 5.7-2. Remove the rotator drive group, Paragraph 5.8-1.
3. Remove the upper mounting hooks.
4. Remove the two baseplate retaining capscrews closest to each upper mounting hook bolt pattern. Replace the two capscrews with eyebolts. Attach a hoist chain to each eyebolt. Lift the hoist chains to take out the slack.

> **WARNING:** Make sure your hoist has a rated capacity of at least 1000 pounds.

5. Remove the remaining baseplate retaining capscrews. Lift off the baseplate.
6. Remove the hub seal from the rotator hub.

For Reassembly, Lube Torque to:	
C2, C3	74-76 ft.-lb.
C4, C6	85-90 ft.-lb.
C7	180-200 ft.-lb.

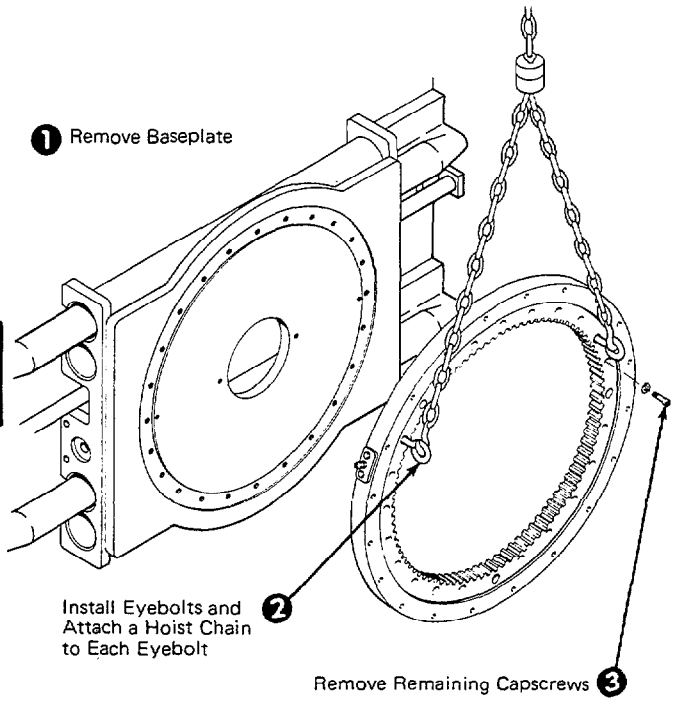

Install Eyebolts Attach a Hoist Chain to Each Eyebolt
4
3 Remove Mounting Hooks
5 Remove Remaining Baseplate Capscrews
6 Remove Rotator Hub Seal

5.10-2 Ring Gear/Bearing Assembly Removal

1. Remove the baseplate assembly as described in Paragraph 5.10-1.
2. Replace two ring gear retaining capscrews with eyebolts. Attach a hoist chain to each eyebolt. Lift the hoist chains to take out the slack.

> **WARNING:** Make sure your hoist has a rated capacity of at least 1000 pounds.

3. Remove the remaining capscrews and lift the ring gear/bearing assembly from the attachment.

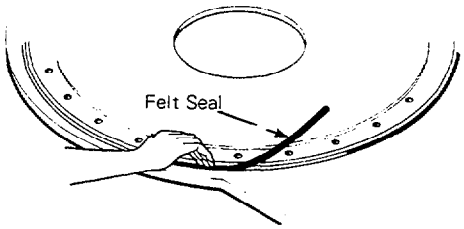


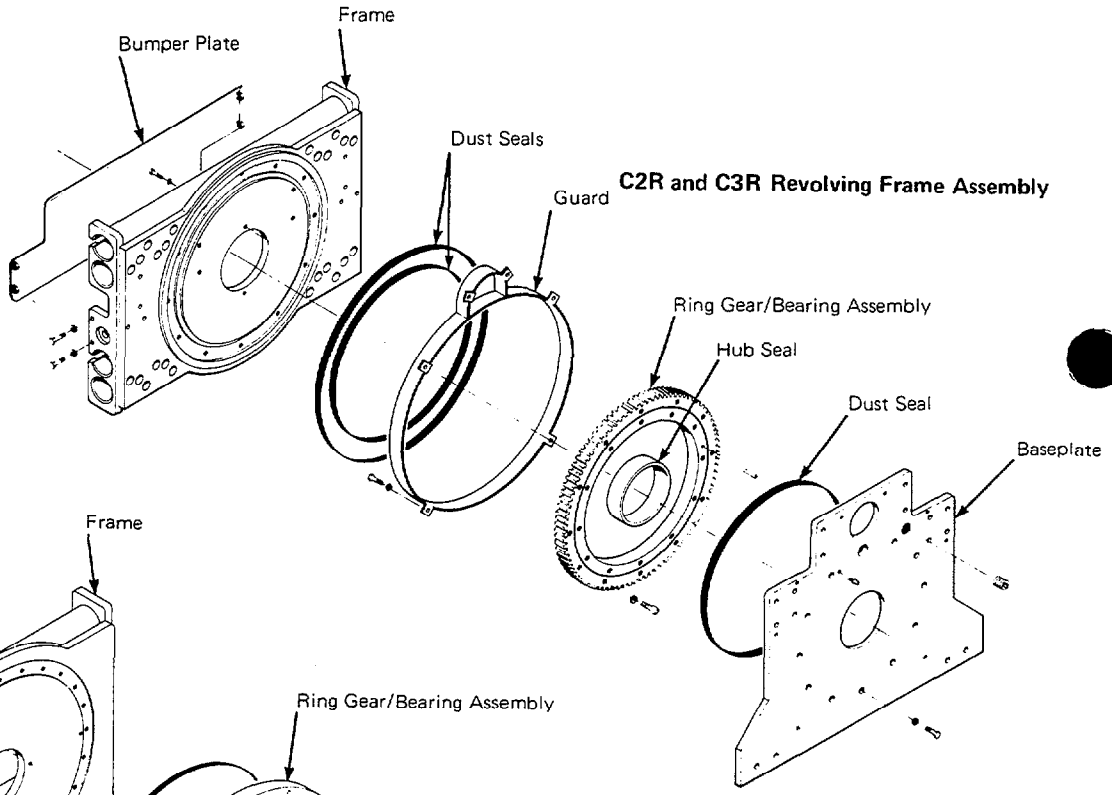
For Reassembly, Lube-Torque to: 65–70 ft.-lb. (C7: 120–125 ft.-lb.)

5.10-3 Frame Assembly Service

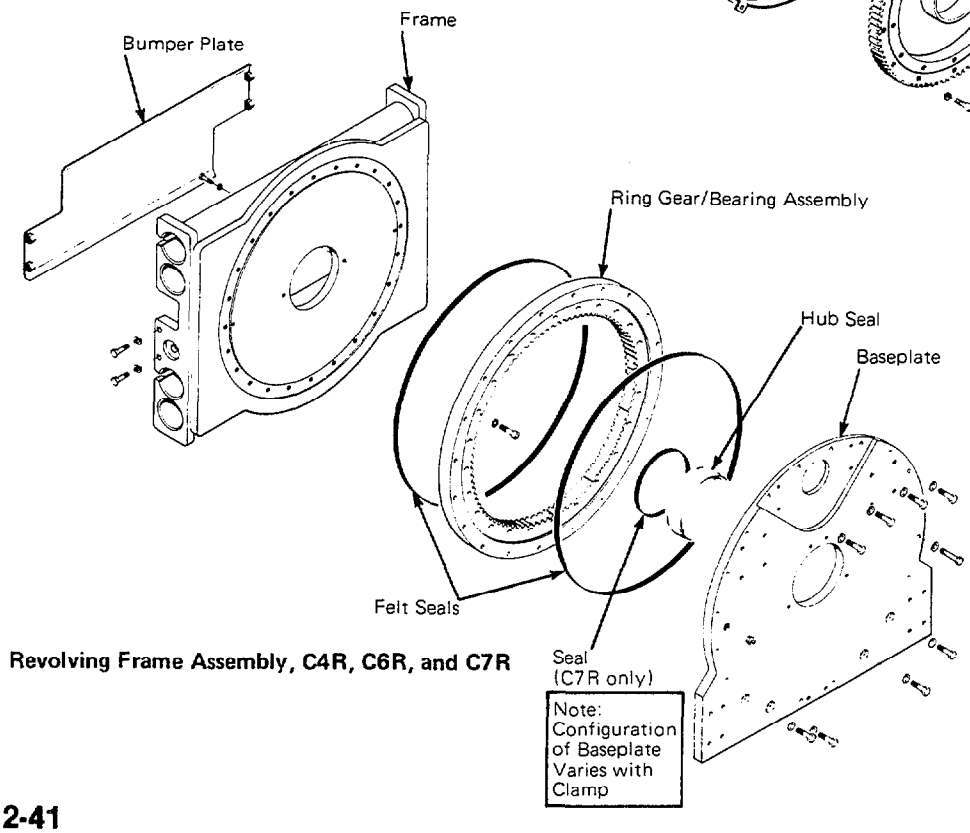
The ring gear and bearing are matched components and must be replaced as an assembly. Whenever the frame assembly is disassembled, the felt seals must be replaced with new ones as follows.

1. Remove the old felt seals and clean the grooves.
2. To install a new seal, start one end of the seal strip in the groove.
3. Push the seal to the bottom of the groove all the way around the groove. If the seal is too short, stretch it evenly around the groove to lengthen it.
4. Cut the two ends of the seal so they meet squarely.
5. Bond the ends of the seal with 3M-brand weatherstrip adhesive No. 8001 or equivalent. After the adhesive dries, lubricate the seal with SAE30 motor oil to swell the seal into the groove.





C2R and C3R Revolving Frame Assembly



Revolving Frame Assembly, C4R, C6R, and C7R

10-4 Frame Reassembly

1. Attach the hoist chain to the ring gear eyebolts and lift the ring gear/bearing assembly into position.

   CAUTION: All ring gear/bearing assemblies have a "heat treat overlap" zone. This zone is designated by a stamped letter on the outer ring of the assembly. When installing the ring gear/bearing assembly, the "heat treat overlap" zone must be located in one of the four locations shown.

2. Lube-torque the capscrews to 65-70 ft.-lb. (C7—120-125 ft.-lb.) in the order shown.

   NOTE: Some units have fewer than the 24 capscrews shown here. On these units, lube-torque using a similar pattern.

   IMPORTANT: Apply a liberal quantity of NLGI consistency No. 0 grease to the teeth of the ring gear before continued assembly.

3. Using the hoist chain, lift the baseplate into position on the bearing race.

4. Lube-torque the capscrews in the order shown (some units may have a different quantity of capscrews). Use torque values as follows:

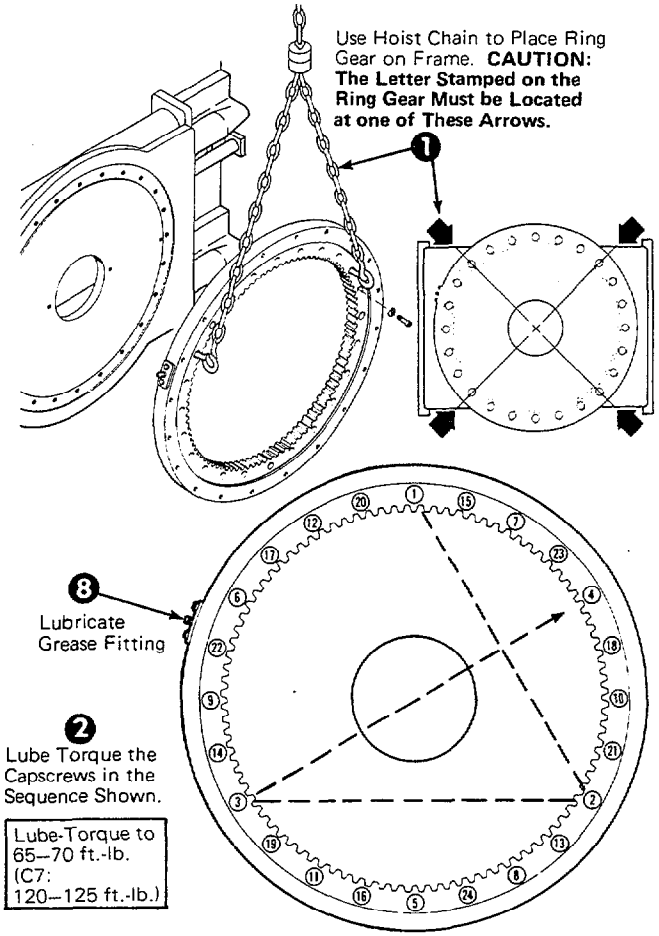
   C2, C3, and C4—65-70 ft.-lb.

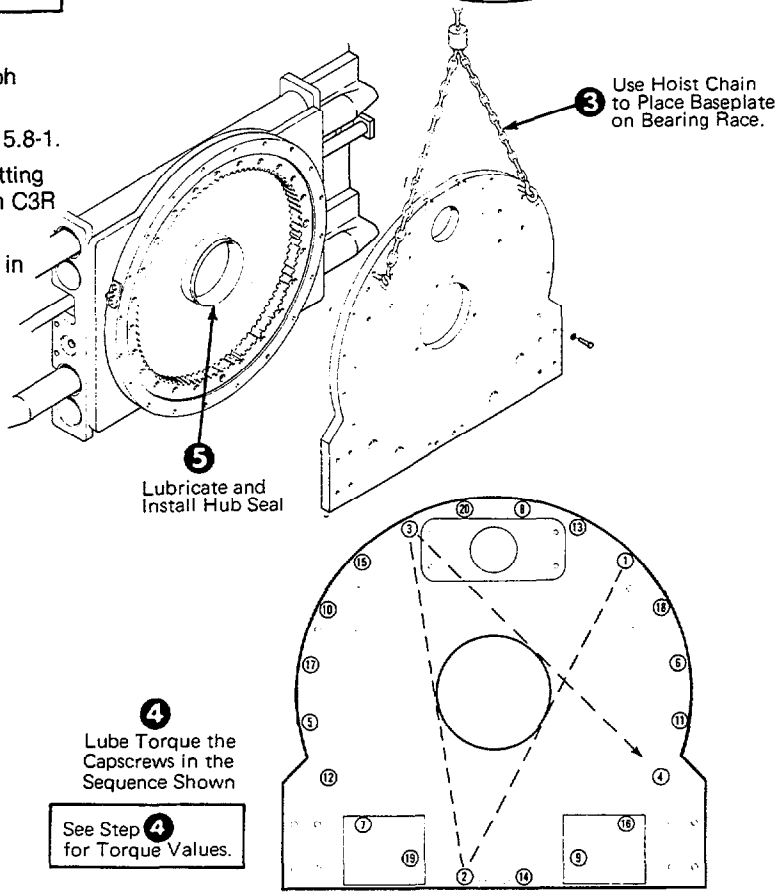
   C6—55-60 ft.-lb.

   C7—200-205 ft.-lb.

> **WARNING:** The capscrews that secure the baseplate to the bearing race must be grade 5 minimum.

5. Lubricate and install the hub seal.
6. Reinstall the revolving connection. See Paragraph 5.7-2.
7. Reinstall the rotator drive group. See Paragraph 5.8-1.
8. Lubricate the bearing race through the grease fitting on the ring gear/bearing assembly (baseplate on C3R clamps).
9. Install the attachment on the truck as described in Section 2.


Use Hoist Chain to Place Ring Gear on Frame. CAUTION: The Letter Stamped on the Ring Gear Must be Located at one of These Arrows.
1
8
Lubricate Grease Fitting
2
Lube Torque the Capscrews in the Sequence Shown.
Lube-Torque to 65—70 ft.-lb. (C7: 120—125 ft.-lb.)


3
Use Hoist Chain to Place Baseplate on Bearing Race.
5
Lubricate and Install Hub Seal
4
Lube Torque the Capscrews in the Sequence Shown
See Step 4 for Torque Values.

Section 6 Standard Labor Times

6.1 Standard Labor Time is the average time required to perform each operation described in Section 5, Service. Each Standard Labor Time is identified by the Service Section paragraph number and title that corresponds to that operation.

The Standard Labor Times are based on the assumption a qualified serviceman is working on a reasonably clean attachment with adequate tools. We realize the actual time required to perform an operation may occasionally be greater than that listed, especially if a "first time" serviceman lacks the needed tools, or if a bolt is frozen. But considering all factors that can affect the job, Cascade can only honor warranty labor claims based on these carefully evaluated averages.

We strongly urge servicemen to read the applicable Service Sections of the manual before repairs are initiated. If problem diagnosis is difficult, call the Cascade Service Department at 1-800-547-5266 (toll free), or, in Oregon, call 666-1511.

To arrive at the total Standard Labor Time for a job, list each operation and add the times. As an example, to replace bushings, your list should look something like this:

5.1	Clamp Removal and Installation	0.8
5.2-1	Arm Removal and Installation	1.0
5.2-6	Arm Bushing Replacement	1.0
	Total Standard Labor Time	2.8

6.2 Standard Labor Times

Paragraph Number		Times
5.1	Clamp Removal and Installation	0.8
5.2-1	Arm Removal and Installation	1.0
5.2-2	Arm Carrier/Load Arm Disassembly and Reassembly	0.5
5.2-3	Turnafork Arm Disassembly and Reassembly	2.5
5.2-4	Turnafork Arm Service	0.5
5.2-5	Turnafork Arm Indexing	0.3
5.2-6	Sliding Arm Bushing Replacement, Two-Piece Style	1.0
5.2-7	Sliding Arm Bushing Replacement, One-Piece Style	1.0
5.3-1	Cylinder Removal and Installation	0.5
5.4-1	Cylinders with V Seals	0.8
5.4-2	Cylinders with U-Cup Seals	0.8
5.5-1	Restrictor Fitting Service	0.5
5.5-2	Restrictor Fitting Adjustment	0.5
5.6-1	Check Valve Removal and Installation	1.8
5.6-2	Check Valve Service	0.7
5.7-1	Revolving Connection Cartridge-Type Check Valve Service	0.7
5.7-2	Revolving Connection Removal and Installation	1.0
5.7-3	Revolving Connection Service	0.9
5.8-1	Rotator Drive Group Removal and Installation	0.5
5.8-2	Rotator Drive Group Disassembly and Service	1.5
5.8-3	Rotator Drive Group Reassembly	1.5
5.9-1	Motor Removal and Installation, Revolving Clamps Only	0.8
5.9-2	Motor Disassembly, Service and Reassembly	1.0
5.10-1	Baseplate Removal	1.0
5.10-2	Ring Gear/Bearing Assembly Removal	1.0
5.10-3	Frame Assembly Service	1.0
5.10-4	Frame Reassembly	2.0

Pride in Service

NATIONAL ASSOCIATION OF SERVICE MANAGERS

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Dial Directline
800-547-5266
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